VOL. XVI No. 1

JANUARY 1931

MECCANO MAGAZINE

BRIDGING MONTREAL HARBOUR

(see page 2)

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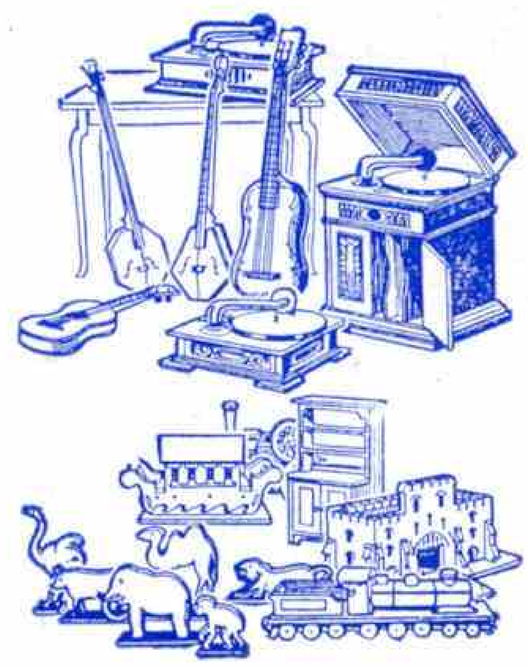

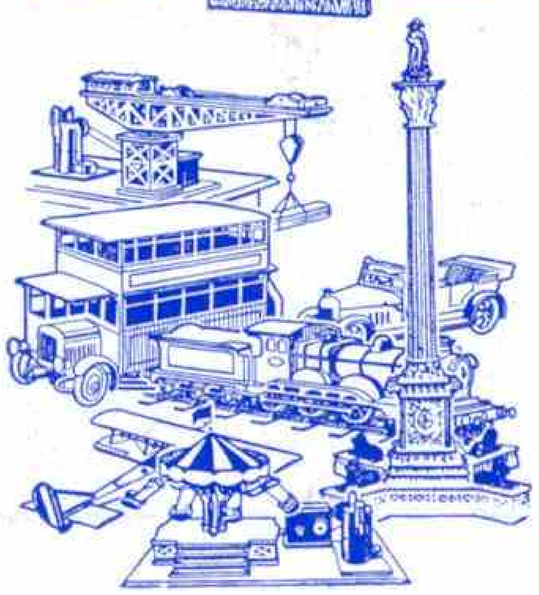

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NEXT MONTH: THE WORLD'S LARGEST LORRY. PUBLISHED: 31st JANUARY

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January, 1931

With the Editor

Best Wishes for the New Year

My first task this month is to wish readers "A Happy New Year." As usual I have received a great number of cards and letters from all parts of the world, and practically every nationality is represented in the pile of greetings that is now in front of me. It includes communications from China and Japan in the Far East; South Africa, Australia and New Zealand in the southern hemisphere; and Canada, the Argentine and other countries in the West. This is not surprising for, of course, there are very few lands into which the "*M.M.*" does not find its way, and reading through my ordinary correspondence provides me with many interesting lessons in geography!

Outstanding Flights during 1930

During the last few weeks I have been wondering if readers have realised that in many respects 1930 has been the most momentous year since the end of the war. At first glance it does not appear to have been distinguished by any really outstanding features in engineering, aviation or railway matters—the topics with which the "*M.M.*" is chiefly concerned—but the progress that has been made suggests that we are on the eve of interesting developments.

Let us take aviation, for instance. During the year the Atlantic has twice been crossed in the air from east to west, and once in the opposite direction. To a certain extent Atlantic flights have lost the glamour they had in 1927, when Lindbergh made his celebrated crossing by air, but those that were accomplished during 1930 show that we are nearer the time when transatlantic journeys may be made regularly in this manner.

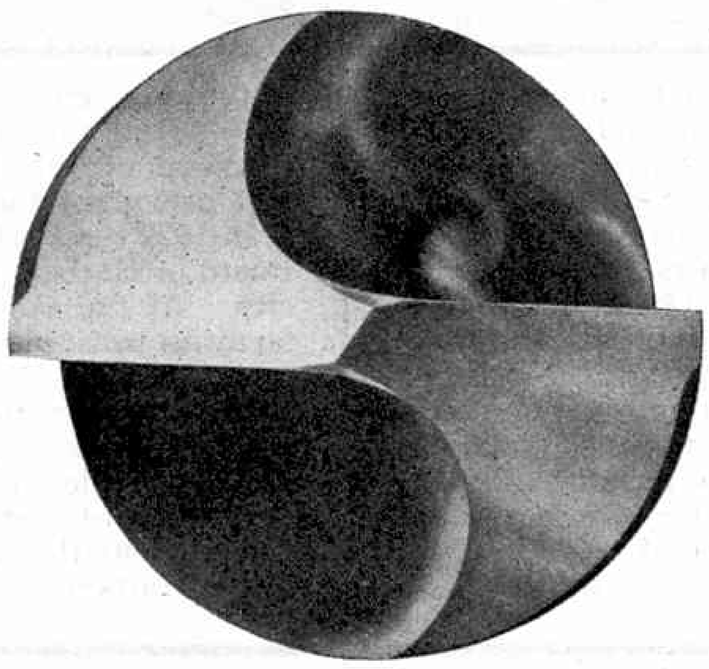
The most interesting Atlantic crossing of last year probably was that of Herr von Gronau, a German airman who flew to Canada in easy and comfortable stages in a Dornier "Wal" flying boat. He followed a northern route, calling on the way at Reikjavik, in Iceland, Ivigtut, in Greenland, and Cartwright, Labrador. When the time comes for a regular service between Europe and America, the flights will be made in similar stages, but on a southern route and, in fact, plans are already being made for the establishment of an air line from this country to the United States by way of the Azores and Bermuda. British and American interests are concerned jointly in this scheme, and according to the information at present available, the service will be maintained by giant flying boats. The venture will need careful planning and preparation, but aeroplanes are rapidly becoming safer and more reliable, and there seems no reason why regular Atlantic crossings should not shortly be made in the manner suggested.

The amazing procession of light aeroplanes from this country to Australia is another proof of the growing reliability of aircraft. It may almost be said that there is now a well-defined air route from Croydon to Port Darwin, for a surprising number of aviators have followed Flt. Lt. Hinkler's example and in "Gipsy Moths," Avro "Avians" and Desoutters—all machines of British make—have tried to improve upon his wonderful time of 15½ days for the flight of 11,000 miles. One of the most remarkable of these attempts was that of Miss Amy Johnson, who arrived at Port Darwin 20½ days after leaving England; but the record stood until August, when Wing-Commander Kingsford Smith reduced it by one-third. In an Avro "Avian" this famous aviator travelled at an average speed of more than 1,000 miles a day and arrived in Australia only 10½ days after leaving Croydon. This wonderful achievement stamped the Australian airman as one of the outstanding figures in the history of aviation.

If the plans I have mentioned are carried out, in a few years it may become possible to fly from San Francisco to Delhi or to Cape Town, for the new services will link up with existing lines in the United States and with the service from this country to India. The next step will be an extension to Australia. When that has been accomplished connecting branch lines will be established, and the world will then be almost encircled by regular air lines that in time may become as crowded with aeroplanes as the recognised ocean trade routes are with shipping. It is probable that 1931 will see great advances made towards this ideal.

In ship-building the year 1930 has been one of preparation for the future. The Blue Riband of the Atlantic remained in German possession, but this state of affairs may be regarded without great misgiving, for in the last month of 1930 the contract for a new British vessel to surpass the German ships was signed. Giant ocean liners cannot be built in a day, of course, and it is not expected that the 70,000-ton Cunarder to be constructed on the Clyde will be launched before 1932. Her first voyage will be made in 1933, therefore, but if the expectations of the engineers who have designed her are fulfilled, this country will then possess the largest, fastest, and most luxurious ocean liner ever built.

No. 26. WHAT EVER IS IT?



Here is the twenty-sixth puzzle in the popular series of mystery photographs.

Can you identify this mysterious object?

To the first reader to send an exact answer, or, if nobody is successful in this, to the one who gets nearest, I will send an autographed copy of my book "Engineering for Boys."

Solutions should be written on postcards only and addressed "Editorial Competition, No. 26, 'Meccano Magazine,' Old Swan, Liverpool." Closing date, 31st January, 1931. For result of Contest No. 25 see page 96.

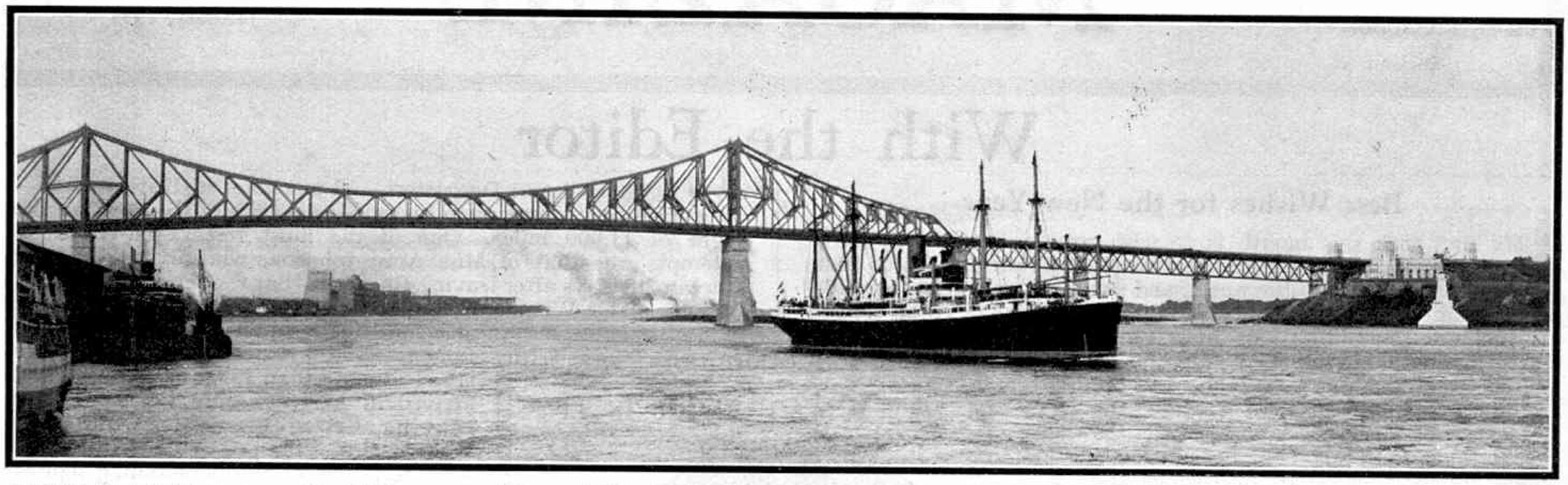
Locomotives of the Future

In the railway world the events of 1930 also have been full of promise of interesting developments. In the past few years the four British railway groups have built giant locomotives that are fully capable of hauling the heavy trains that the demands for increased luxury and comfort in travel have made necessary. Locomotive engineers are always looking ahead, however, and during 1930 interesting experiments were made for the purpose of developing engines of greater efficiency and economy.

Of recent experimental locomotives "No. 10000," the wonderful compound high-pressure engine designed by Mr. H. N. Gresley, Chief Mechanical Engineer of the L.N.E.R., has aroused the greatest public interest. This engine has satisfactorily completed a series of trials in actual service, and it will be interesting to see what effect its success will have on locomotive design on the L.N.E.R.

The Montreal Harbour Bridge

A Two-Mile Highway Across the St. Lawrence



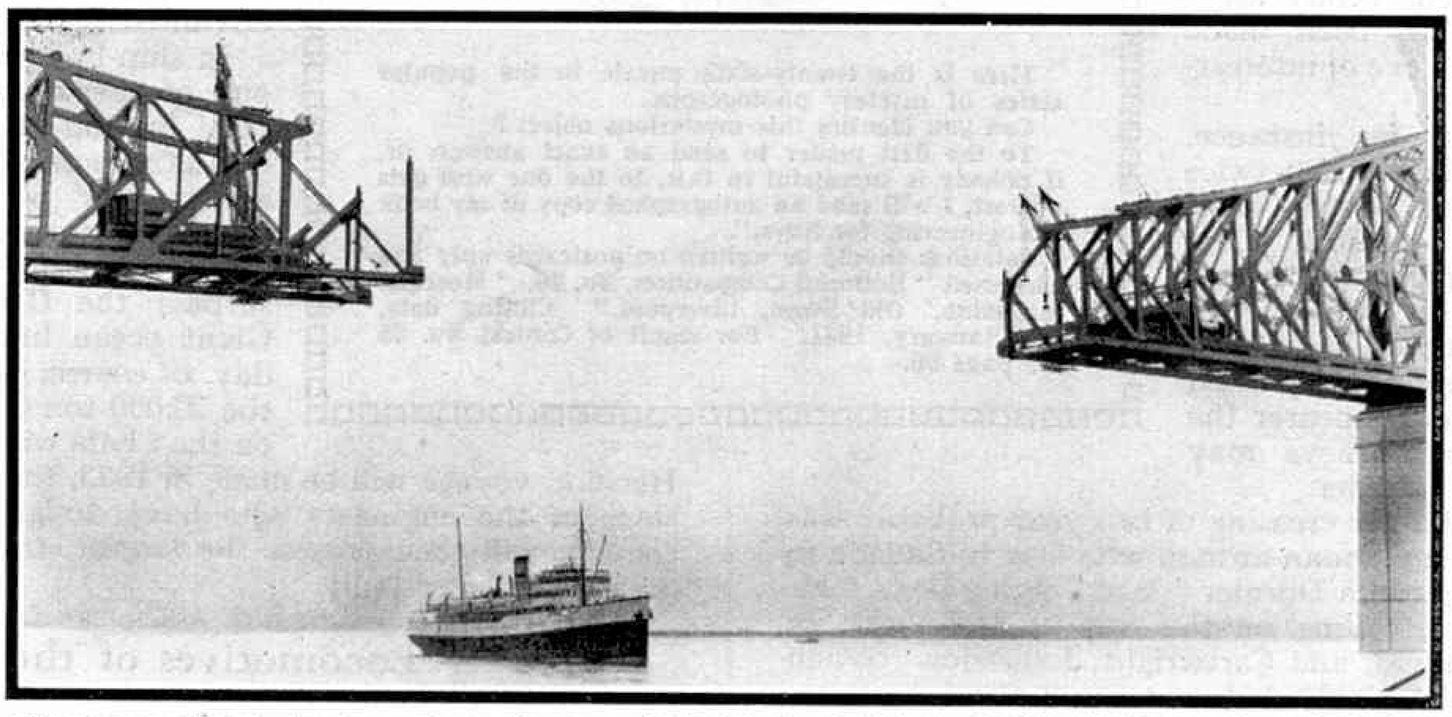
THE first bridge across the St Lawrence River at Montreal was the Royal Victoria Bridge, which is of special interest as having been designed by Robert Stephenson, who was also the Chief Engineer for its construction. As originally built it was of the tubular type, and it resembled very closely Stephenson's Britannia tubular bridge across the Menai Straits. At the point where the Victoria bridge was built the river is 1¾ miles in width, so that the task of bridging it was very great. Local conditions added to the difficulties, for the river attains a speed of eight or nine miles per hour at high water, and in Spring immense quantities of ice come downstream and, under pressure from behind, pile themselves up against any obstacles, such as the piers of a bridge.

The construction of the Royal Victoria Bridge was begun on 22nd July, 1854, and was completed, at a total cost of £1,300,000, on 17th December, 1859, about two months after the death of Robert Stephenson. It was formally opened for traffic early in 1860. As originally designed the bridge had a single railway track and carriageways and footpaths. In 1897 it was altered considerably, the piers being renewed and the great tubes replaced by steel trusses. During this reconstruction a double railway track was provided.

For about 30 years this bridge proved adequate for both rail and road traffic, but as the city developed and traffic increased it became evident that some additional means of cross-river communication was necessary. A second bridge was suggested, and in 1895 the Montreal Bridge Company offered prizes for the best designs for a high level bridge to be erected near the existing structure. Several engineers submitted designs, but no practical results followed.

As the years went on, the question of a second bridge over the river was brought up at intervals; but although various schemes were discussed an actual bridge seemed as far off as ever. The rapid development of Montreal on the north bank, and of a thriving suburban district on the south bank, made better means of communication continually more urgent, and in particular the ever-growing motor traffic increasingly overtaxed the limited facilities of the existing bridge. The seriousness of the position was emphasised during the summer of 1920 when a large portion of the timber roadway of this bridge was destroyed by fire, causing serious and prolonged inconvenience to traffic.

In 1922 renewed pressure was brought to bear upon the Montreal Board of Harbour Commissioners by many business interests in the city. At the same time the urgent need of improved trans-river facilities was placed before the Federal Government, with the result that the Minister of Marine requested the Montreal Harbour Board to investigate the situation. The Board were called upon to make surveys, soundings, and borings in order that preliminary designs and plans might be prepared for the information of the Board and of the Government. With the consent of the Government the sum of £10,000 was appropriated from the funds of the Harbour Board to meet the cost of these preliminary works, which were carried out by the Engineering Department of the Board.



The upper photograph shows the main span of the Montreal Harbour Bridge. This span is 1,097 ft. from centre to centre of the main piers, and is high enough to allow the largest vessels to pass.
The lower photograph shows the cantilever arms of the main span in course of erection. (For the illustrations to this article we are indebted to the Dominion Bridge Co. Ltd., Montreal).

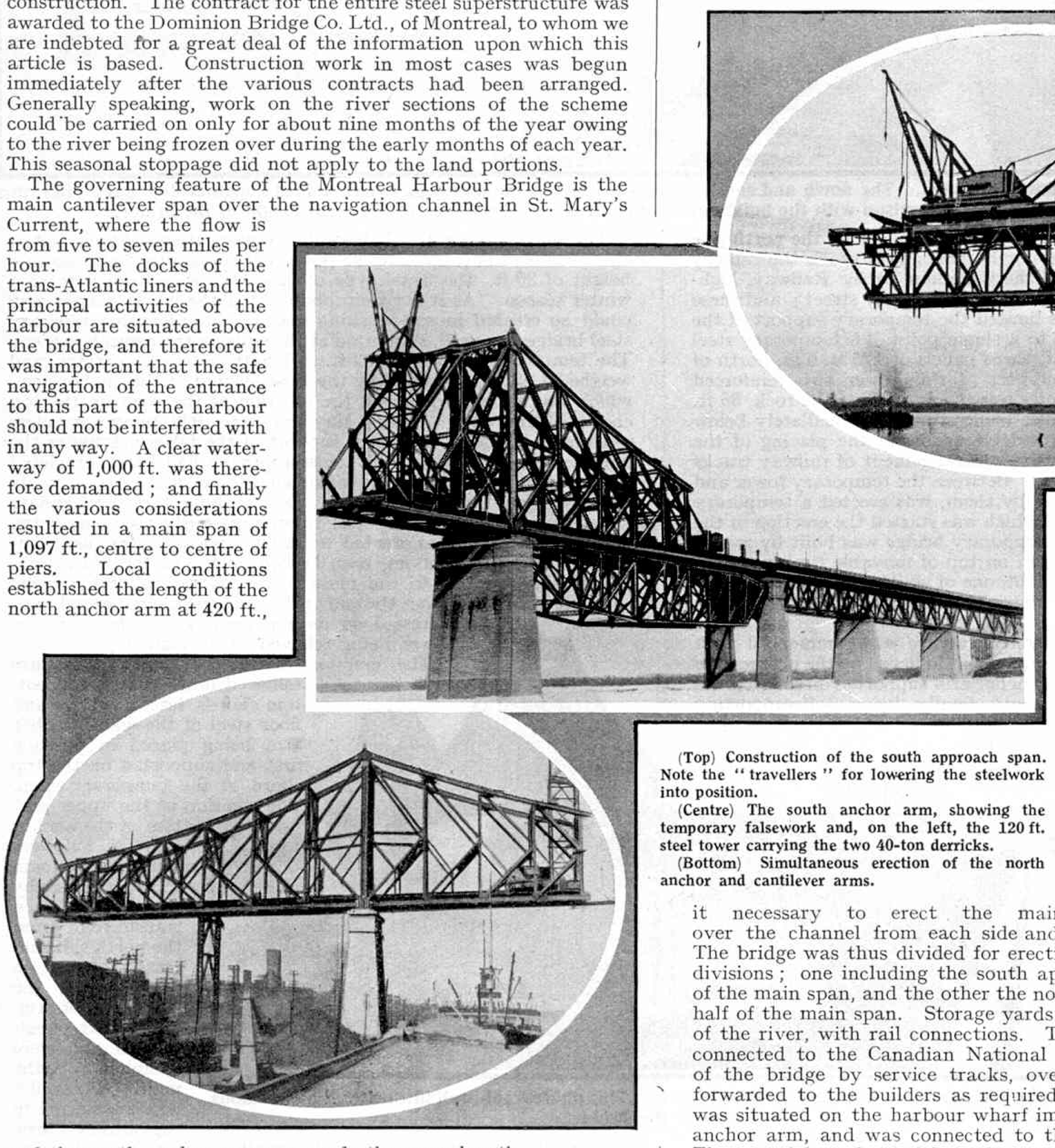
The investigations made it clear that any bridge designed to cross the river at Montreal Harbour must have a clear span of at least 1,000 ft., and must be about 160 ft. above high water to allow the largest ships to pass beneath it at any time. The cost of such a structure with the necessary approaches was at that time thought to be prohibitive. The engineers put forward four alternative bridge schemes, however, in three of which advantage was to be taken of various small islands in the river for the purpose of forming the foundations of some of the piers. Each of these designs involved the costly task of recasting the entire canal basin and canal entrance, involving serious dislocation of shipping while this work was being carried out. The fourth scheme was a much less costly undertaking, and it proposed a highway bridge parallel to the existing bridge. None of these schemes was entirely acceptable to the Board, but the fourth met with most favour. A report on the matter was made to the Minister of Marine in May 1923, and subsequently was brought by him before Parliament.

The Federal Government authorised the Harbour Board to fix

the site for a bridge and to proceed with the designing and erection of a structure, subject to Government approval. During the winter of 1923-4 the Board advertised their requirements for the bridge, and several designs were submitted. The most adequate of these was one proposed by Messrs. Monsarrat and Pratley, consulting engineers of Montreal, in association with J. B. Strauss of Chicago; and in November 1924 these three were appointed joint designing and consulting engineers for the Montreal Harbour Bridge.

During 1925 contracts were given for various portions of the construction. The contract for the entire steel superstructure was awarded to the Dominion Bridge Co. Ltd., of Montreal, to whom we are indebted for a great deal of the information upon which this article is based. Construction work in most cases was begun immediately after the various contracts had been arranged. Generally speaking, work on the river sections of the scheme could be carried on only for about nine months of the year owing to the river being frozen over during the early months of each year. This seasonal stoppage did not apply to the land portions.

The governing feature of the Montreal Harbour Bridge is the main cantilever span over the navigation channel in St. Mary's Current, where the flow is from five to seven miles per hour. The docks of the trans-Atlantic liners and the principal activities of the harbour are situated above the bridge, and therefore it was important that the safe navigation of the entrance to this part of the harbour should not be interfered with in any way. A clear waterway of 1,000 ft. was therefore demanded; and finally the various considerations resulted in a main span of 1,097 ft., centre to centre of piers. Local conditions established the length of the north anchor arm at 420 ft., and the south anchor arm was made the same length.



(Top) Construction of the south approach span. Note the "travellers" for lowering the steelwork into position.

(Centre) The south anchor arm, showing the temporary falsework and, on the left, the 120 ft. steel tower carrying the two 40-ton derricks.

(Bottom) Simultaneous erection of the north anchor and cantilever arms.

The bridge crosses the main channel on a line approximately at right-angles to the dock wall and current; and it touches the upper end of Isle Ronde and crosses the lower end of St. Helen's Island. From the latter point to the south shore the current is not parallel with that in the main channel, and the axis of this portion of the bridge was therefore deflected about 10½ deg. downstream in order to keep the piers parallel with the stream and perpendicular to the bridge axis.

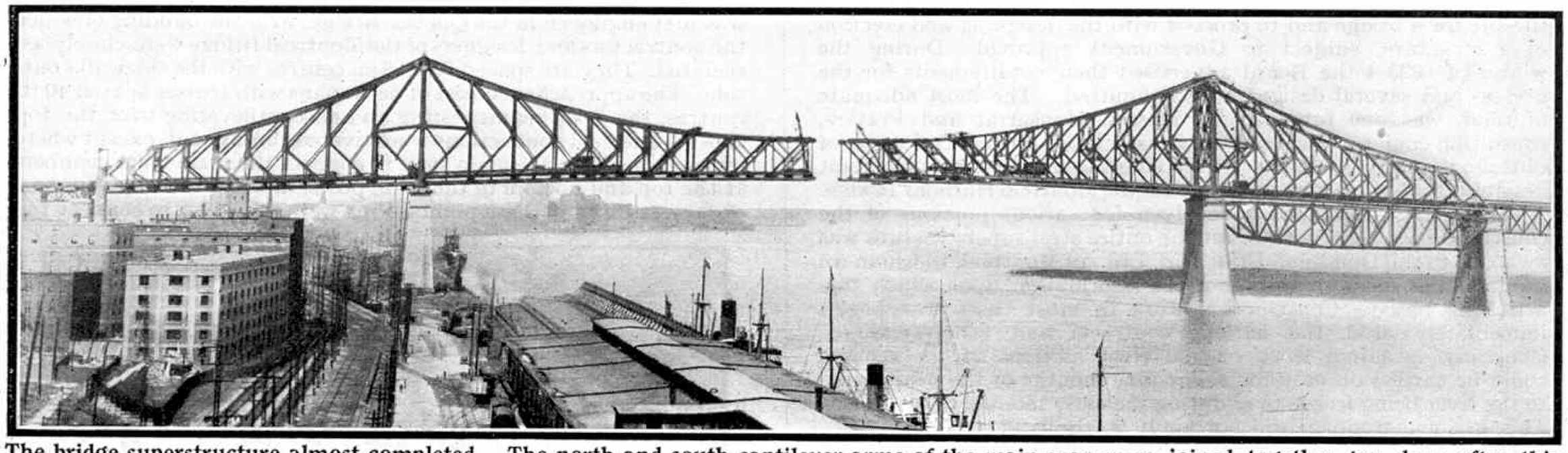
The foreshore of the south channel is subject to severe ice jams and shoves that pile the ice high above the normal level, and it was necessary to keep the steelwork of this section well above the highest recorded levels. The navigation clearance in the main channel was specified as 150 ft. at high water, with 163 ft. for a length of 500 ft. under the centre of the main span.

The bridge is designed to carry a roadway 36 ft. 10¾ in. in width between curbs, providing for four lanes of traffic; two electric tramway tracks 15ft. 6 in. centres on each side of, and clear of the roadway; and a 5 ft. sidewalk on each side of the bridge. The trusses of the main cantilever span have the K-system of bracing that was first employed in the Quebec Bridge, with the building of which the contractors and designers of the Montreal Bridge were closely associated. They are spaced 66 ft. 6 in. centres with the sidewalks outside. The approaches consist of deck spans with trusses spaced 40 ft. centres, the floor beams resting on and cantilevering over the top chord. The field connections were riveted throughout, except where pins were used on the main span to connect the main truss members at the top and bottom of the main posts, in order to reduce the secondary stresses at these points. Pins were used also to connect the anchorage members and in the ends of the hangers connecting the suspended span to the cantilever arms. Silicon steel was used for the truss members of the 245 ft. span of the south approach; and in the floor system, bracing and trusses of the main span whenever weight could be saved by its use. Of the total weight in the main span 67 per cent. is silicon steel. All pins were of forged nickel steel.

Provision for unobstructed navigation made it necessary to erect the main span by cantilevering over the channel from each side and connecting at the centre. The bridge was thus divided for erection purposes into two main divisions; one including the south approach and the south half of the main span, and the other the north approach and the north half of the main span. Storage yards were installed on each side of the river, with rail connections. The south storage yard was connected to the Canadian National Railways and to the floor of the bridge by service tracks, over which the material was forwarded to the builders as required. The north storage yard was situated on the harbour wharf immediately below the north anchor arm, and was connected to the harbour railway tracks. The material was hoisted from the ground to the floor of the bridge above, and distributed to the builders over service tracks.

Work was commenced at the south shore in September 1926, seven spans being erected by the end of the season. In the following Spring work was resumed on this section, and rapid progress was made as soon as the pier construction was sufficiently advanced. During a period of seven weeks, from 15th August to 6th October, seven spans were erected, representing a length of 1,750 ft. and a weight of 4,190 tons. By the end of the season the steelwork of a pavilion on St. Helen's Island, the roof of which was to form a portion of the bridge deck, was erected, together with the flanking span beyond. Circumstances made it necessary to leave the completion of the three remaining spans until the Spring of 1928.

The spans of the south approach were erected either on timber falsework or by cantilevering. Three of the four 150 ft. spans and ten of the twelve 245 ft. spans were cantilevered, a temporary harness being used in the latter spans to increase the effective depth of the trusses at the piers. The method employed is illustrated by the top photograph on this page, which shows one of these spans in course of erection.



The bridge superstructure almost completed. The north and south cantilever arms of the main span were joined together ten days after this photograph was taken. Comparison with the buildings on the left gives a good idea of the great height of the bridge.

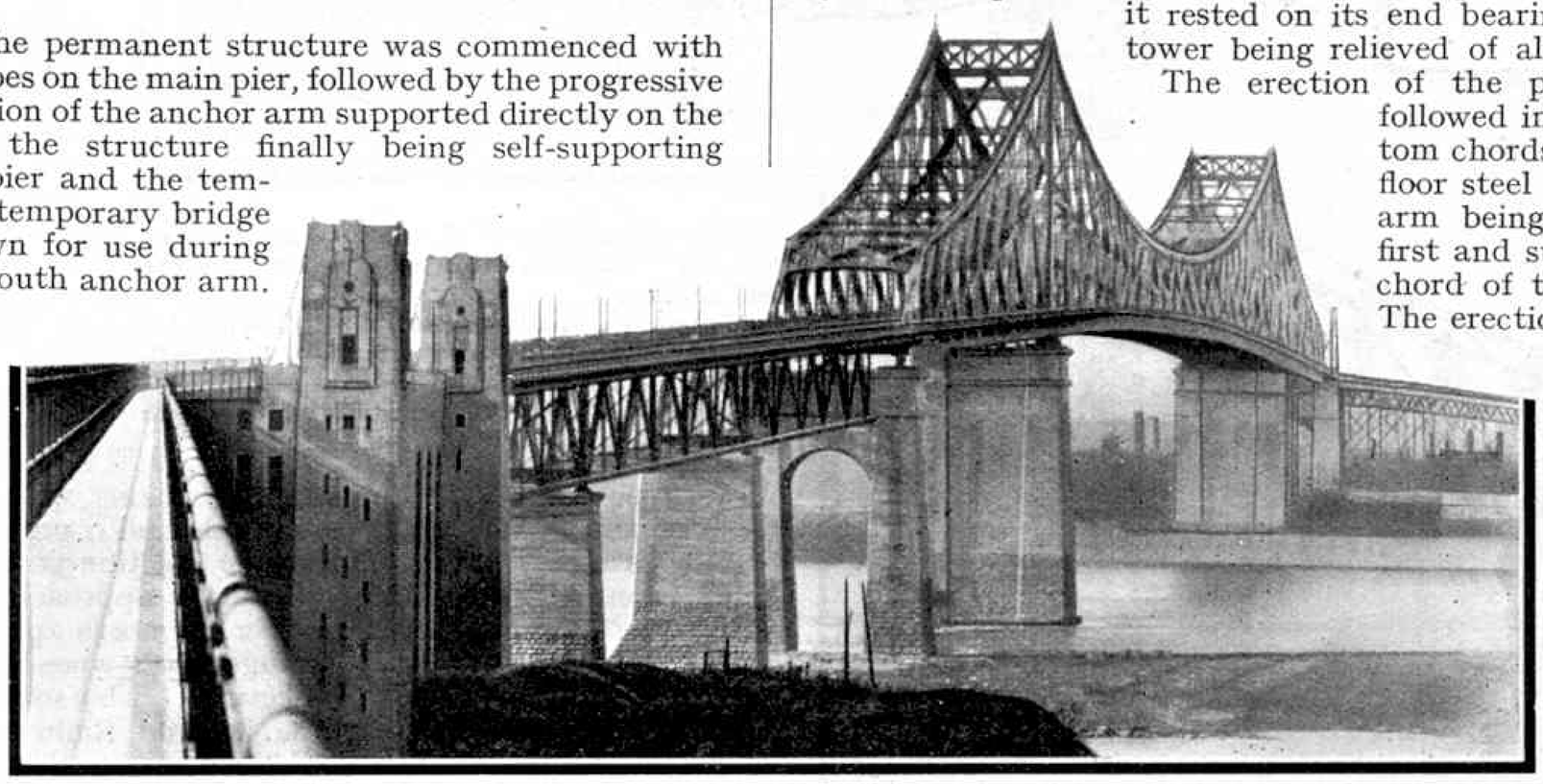
The erection of the main span was commenced on the north side in the Spring of 1927. The north anchor arm spans the railway tracks of the harbour and of the Canadian Pacific Railway, high-tension power lines, a large building, and a busy street; and these congested ground conditions limited the temporary support of the anchor arm during erection to a single point. A temporary steel tower was built at this point, three panels or 175 ft. 6 in. north of the main pier. For the support of this tower two reinforced concrete piers 12 ft. in diameter were sunk down to the rock, 85 ft. below ground surface, one pier being situated immediately below each anchor arm truss. In order to allow of the placing of the tower at this point an extensive rearrangement of railway tracks and power lines was necessary. Between the temporary tower and the main pier, and supported by them, was erected a temporary steel bridge, from the deck of which was started the erection of the permanent structure. This temporary bridge was built by means of two 50-ton derricks mounted on top of movable timber towers 40 ft. square and 120 ft. in height, one of which was set up on each side of the structure. The derricks were equipped with booms 75 ft. in length.

The erection of the permanent structure was commenced with the placing of the shoes on the main pier, followed by the progressive assembly of the portion of the anchor arm supported directly on the temporary bridge, the structure finally being self-supporting between the main pier and the temporary tower. The temporary bridge was then taken down for use during the erection of the south anchor arm. The upper portion of the structure was erected by means of a traveller set up on the floor of the bridge. This traveller was of steel construction and consisted of a tower 120 ft. in height, on top of which were mounted two 40-ton derricks in fore-and-aft fashion, so that both the 70 ft. booms could work together on either side. In working order the traveller weighed 300 tons. On the completion of a portion of the anchor arm extending from the main pier to one panel beyond the temporary tower, the main traveller was transferred to the channel side of the main pier and the erection of the cantilever arm was commenced. By the close of the season some 3,300 tons of permanent structure were erected.

Operations were resumed in March 1928, when the erection of the north anchor and cantilever arms was carried on at the same time in order to partially balance the weight on each side of the main pier, and to reduce the load on the temporary tower and its foundations. An auxiliary traveller was used on the anchor arm and the main traveller progressed outward on the cantilever arm. By the end of May the anchor arm and the larger portion of the cantilever arm were completely erected. The end of the anchor arm was then jacked from the anchor pier until the temporary tower was relieved of all load, and disconnected. It was then lowered to its final position and the pins were driven to connect it to the permanent anchorages. Shortly afterward the temporary tower and the main traveller were removed for use during the erection of the south half of the main span.

The south anchor arm is beyond the navigation channel, but as the river here is subject to ice jams that frequently build up to a height of 30 ft., the usual type of falsework would not survive a winter season. As it was improbable that the whole anchor arm could be erected in one working season, a full-length temporary steel bridge was used, supported at the ends by the respective piers. The temporary span was 402 ft. in length between bearings, and weighed 1,625 tons, including the floor system of the anchor arm, which was supported during the erection of the span on the top chords of the latter. During May and June 1928, temporary piers were built in the river for the support of the falsework under the temporary span. When the south approach had been completed the erection of the span was commenced, the first portion being supported on timber falsework. On reaching the approximate mid-point of the span the steel tower previously used under the north anchor arm was erected on the temporary piers just mentioned. The span, having been landed on top of the tower, was cantilevered beyond to the main pier. By means of hydraulic jacks on top of the tower, the end of the span was then lowered until it rested on its end bearings at the pier, the tower being relieved of all load.

The erection of the permanent structure followed immediately, the bottom chords, lateral system and floor steel of the whole anchor arm being placed in position first and supported on the top chord of the temporary span. The erection of the upper portion of the anchor arm followed, using the main traveller, which by this time had been transferred from the north side and reassembled on the floor of the south anchor arm. When four panels of this arm were completed, the main traveller was transferred to the cantilever arm, and erection was proceeded with simultaneously on both arms up to the close of the season.



View of the bridge as seen from the south approach. This photograph well illustrates the enormous length of the bridge.

Advantage was taken of the winter to erect the north approach viaduct, making use of the equipment employed at an earlier date in the erection of the south approach.

Shortly after the resumption of operations in April 1929, the south anchor arm was completed, and with it the major portion of the south cantilever arm. The end of the anchor arm was then connected to its permanent anchorages. The temporary span was thus relieved of all load, and subsequently it was removed. Auxiliary travellers completed the erection of the outer ends of both cantilever arms, operations proceeding at the same time on both sides of the channel. The erection of the central suspended span followed, the gap between the ends of the respective arms rapidly narrowing until by 1st July the centre panel alone remained. Soon afterward this panel was completed, the final operation of making the closure connections at the centre being carried out on 10th July the same year.

The preparations for the closure operations were elaborate, and in planning them certain considerations had to be carefully borne in mind. The suspended span, (*Continued on page 25*)

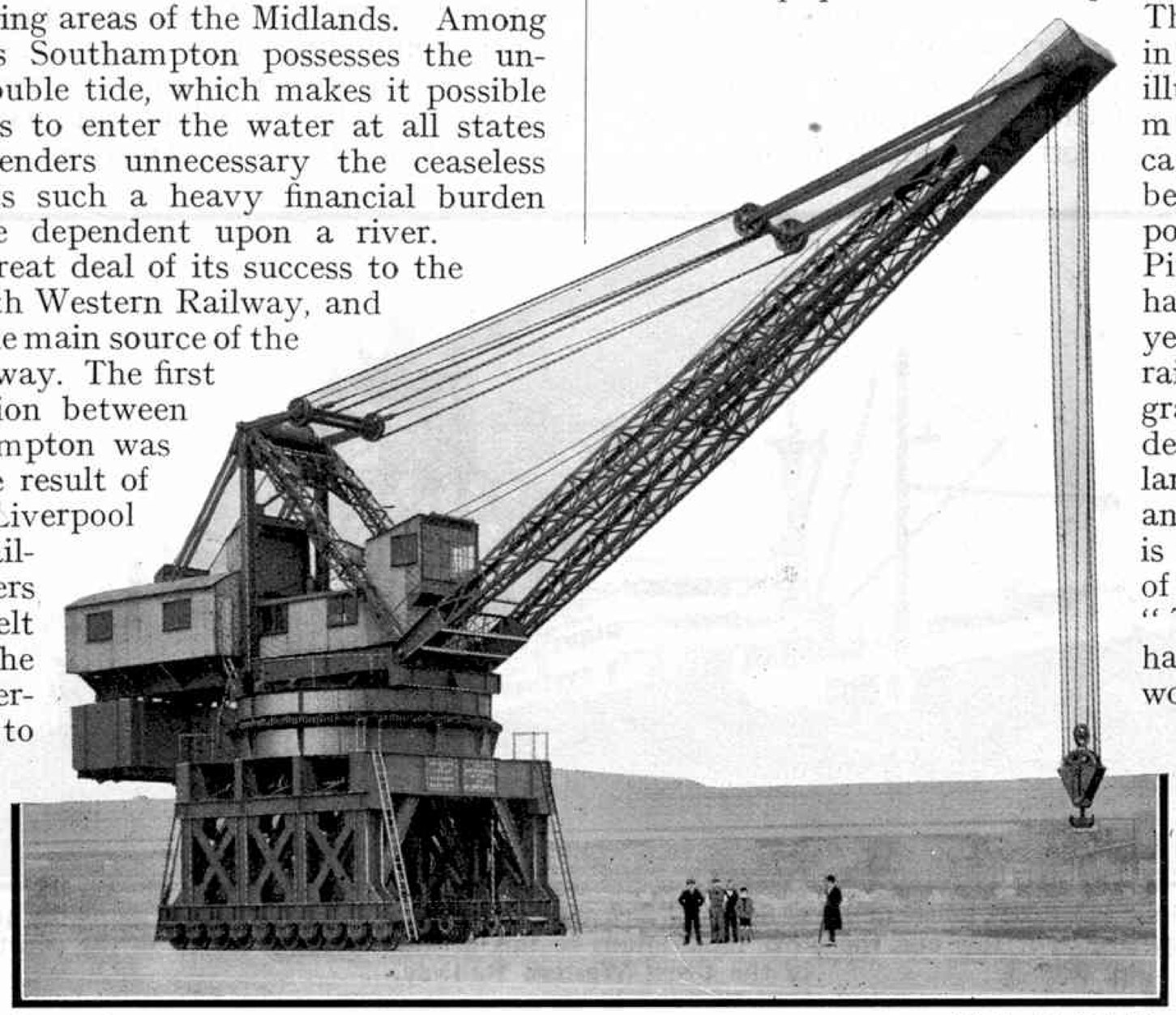
A 50-Ton Portable Electric Crane at Southampton Docks

SOUTHAMPTON has been called the pleasantest of our larger ports, and not without reason. It enjoys a wonderful situation in the middle of the south coast, yet it is less than 80 miles from London, and is within easy reach of the Welsh coalfield and the great manufacturing areas of the Midlands. Among its other advantages Southampton possesses the unusual feature of a double tide, which makes it possible for the largest liners to enter the water at all states of the tide, and renders unnecessary the ceaseless dredging that inflicts such a heavy financial burden upon ports that are dependent upon a river.

The port owes a great deal of its success to the old London and South Western Railway, and in return it became the main source of the prosperity of the railway. The first railway communication between London and Southampton was brought about as the result of the success of the Liverpool and Manchester Railway. The shipowners of Southampton felt uneasy in regard to the development of Liverpool that was likely to result from the railway, and they determined to have a railway of their own. A Bill for the construction of the London and Southampton Railway was passed in 1834, and in due course work commenced. Serious engineering difficulties had to be overcome, however, and progress was slow. By June 1839, it was possible to reach Southampton from London by taking train from London to Basingstoke, coach from Basingstoke to Winchester, and train again forward to Southampton. The first through train from London to Southampton ran in May 1840. After this line was opened the people of Portsmouth decided that they would like a branch from it, but they insisted that the name should be altered to London and South Western, to avoid the use of the name of the rival port!

The best-known feature of the splendid equipment of the port is of course the floating dock that possesses the distinction of being the largest in the world. All "*M.M.*" readers will be familiar with photographs of this famous dock, engaged in lifting various giant liners. This huge structure has a lifting capacity of 60,000 tons, an overall length of 960 ft., and an inside width of 130 ft. Its greatest feat was the lifting of the White Star liner "*Majestic*," in 1925. This was performed without the slightest hitch, and the unique sight of the world's largest liner resting in the world's largest floating dock aroused great public interest.

Southampton was among the first ports in the United Kingdom to recognise the advantages of electric cranes, and its equipment in this respect is now very complete.



Courtesy] [*Stothert & Pitt Ltd.*

A 50-ton portable electric crane at a graving dock at Southampton.

The 50-ton crane shown in the accompanying illustration is one of many of various capacities that have been supplied to the port by Stothert and Pitt Ltd. This crane has already done 20 years' service at the railway company's graving docks. The design is of a particularly robust character, and the understructure is modelled on the lines of the firm's well-known "Titan" cranes for harbour construction work. Each of the 20 axles of the rail wheels is carried on a group of volute springs.

The hoisting mechanism is housed at the rear of the structure along with the jib derricking gear, the latter being provided with an automatic mechanical brake resistance, which comes into action when the jib is being lowered and goes out of action when it is being raised. The slewing and travelling motors and gear are situated at the centre of the crane housing, and the control cabin at the front is placed in an elevated position that provides the operator with a clear view down into the dock. When at its maximum radius the crane reaches 10 ft. beyond the centre of the dock.

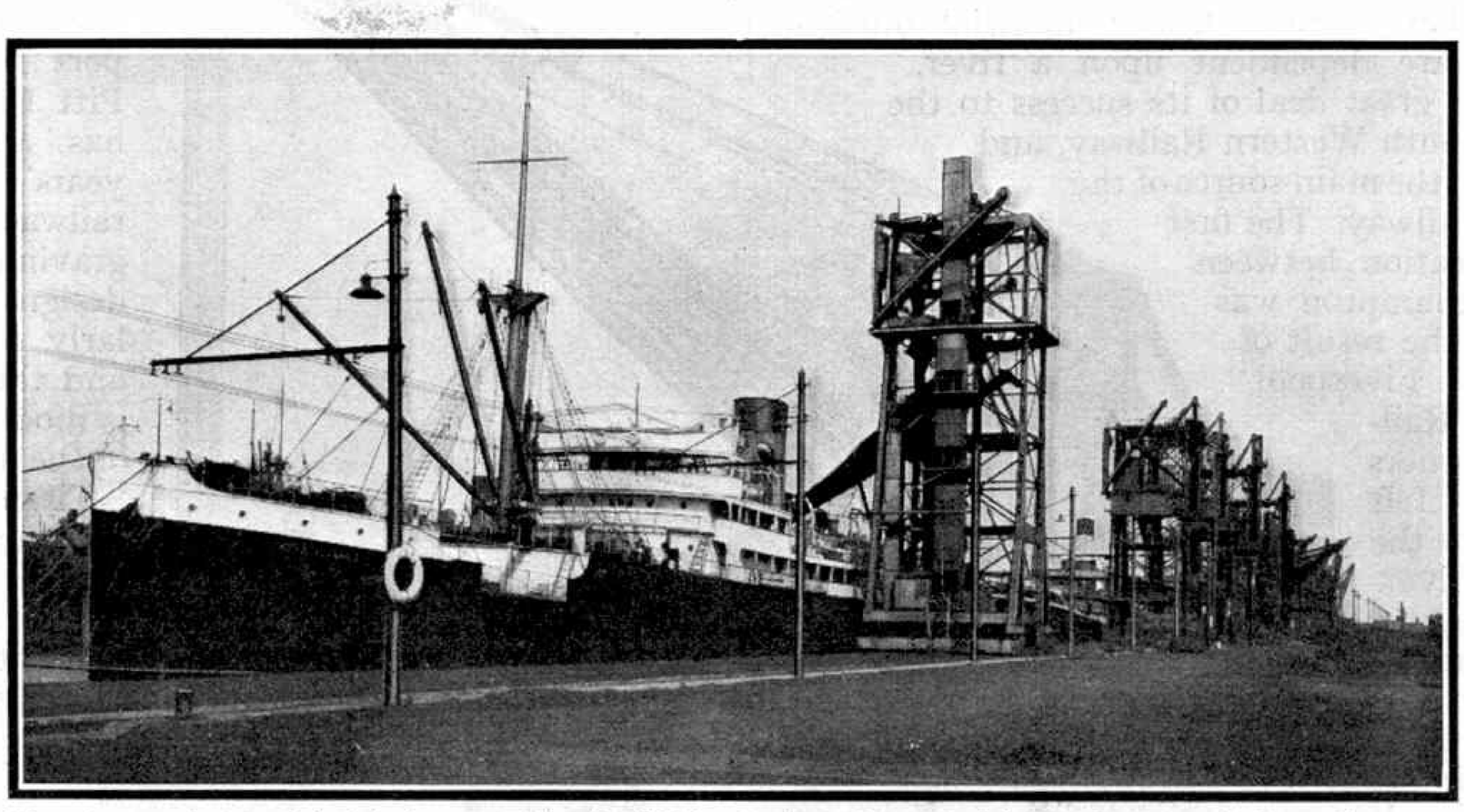
The working load for this crane is 50 tons, with a maximum radius of 87 ft. The height of lift above rails is 47 ft. and the depth below 43 ft., giving a maximum range of lift of 90 ft. The speed of lift with slow gear is 16 ft. per minute, and with fast gear 56 ft. per minute; while the speed of slewing is one revolution in $2\frac{1}{2}$ minutes and the speed of travelling 30 ft. per minute, in each case with load. Five electric motors are incorporated in the crane; two of 50 b.h.p. each for lifting, one of 25 b.h.p. for slewing, one of 80 b.h.p. for derricking, and one of 50 b.h.p. for travelling. The length of the jib, from centre to centre of pins, is $81\frac{1}{2}$ ft., and the total weight of the crane is 355 tons.

South Wales Ports of the G.W.R.

The Sea Outlets of a Great Coalfield

THERE was a time when the Bristol Channel might accurately have been described as the seaway that led to the ancient city of Bristol, after which presumably the Channel was named. Modern developments have resulted in the title being somewhat of a misnomer, however, in that the Channel is to-day a water highway to other ports than Bristol, some of them perhaps equally famous. These ports are on the northern or Welsh side of the Channel, and Cardiff, for instance, is famous as the port from which more coal is sent out every year than from any other port in the world.

It is the existence of the South Wales coalfield so near to a coastline offering the possibilities of making harbours that has led to the creation of the line of docks that lies along the South Wales seeboard. Starting from the upper or eastern end of the Bristol Channel, we have Newport, Cardiff, Penarth, Barry, Port Talbot and Swansea, together forming a group of some of the finest ports in the world. In addition there are smaller ports such as Lydney, Briton Ferry, Neath, Llanelly, and Burry Port.



New traversing coal hoists in use at South Wales docks ; these hoists can be moved along the quay as required. For this and the other illustrations to this article we are indebted to the courtesy of the Great Western Railway.

The docks of Cardiff, Penarth and Barry are included together by the Customs authorities as forming the "Port of Cardiff." From this port alone as much as 26,000,000 tons of coal have been shipped in one year, while the whole of the South Wales ports have shipped over 38,000,000 tons in a year. This represents roughly about 76,000 train loads of 50 wagons each, and the total is so stupendous as to be difficult to grasp.

It must be borne in mind that in the course of a single year between 20,000 and 30,000 ships arrive at and sail from the South Wales ports. At the ports themselves are employed thousands of men engaged in the loading and discharging of the ships ; ship repairing ; provisioning of ships ; working the railway traffic to and from the ships ; handling the ships into and out of dock, and so on. In addition each port constitutes a large town with large numbers of workers in various trades and industries, a host of shopkeepers, and all the features of a busy community. Then behind the ports are the millions of people who find their livelihood in various ways in the coalfield itself.

It is clear, therefore, that these ports on the South Wales coast, which have been created by "King Coal," are very important centres of British trade. The coal that we send forth to the world provides us with the means of purchasing the huge quantities of wheat and other commodities that are necessary to our national life. It is quite a common occurrence for a large tramp steamer to take a cargo of, say, 8,000 tons of coal from South Wales to South America, and bring back a full cargo of wheat from perhaps the Argentine, although of course it does not necessarily follow that the wheat would be brought back to a South Wales port.

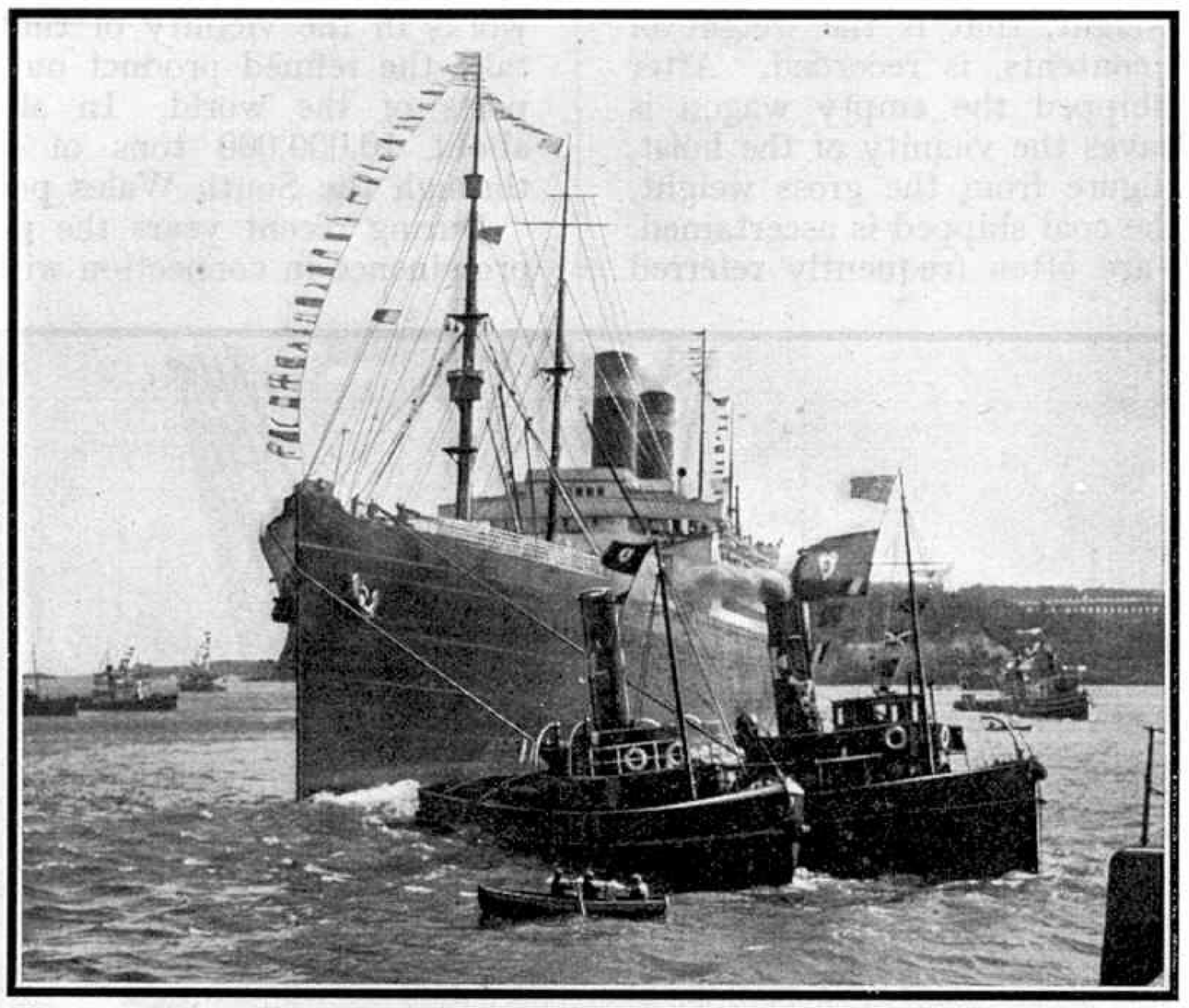
It was about 130 or 140 years ago that the shipment of coal from South Wales began on a systematic scale. In the very early days the coal was brought down from the collieries by mules or pack-horses, each animal carrying a load of about 130 lb., and three or four of them being in charge of a woman or a boy. This method of transport was eventually followed by trams drawn on rails by horses. It is said that the introduction of these horse-drawn trams was strenuously opposed by people who lived along the track, their complaint being that the rumbling of the trains soured the beer in their cellars!

Later the demand for coal led to canals being constructed, the coal being loaded into barges at the collieries and drawn to the docks by horses. The canal method was a great improvement upon the horse-drawn trams. A barge with a load of 24 tons could be drawn by one horse and attended to by one man or a boy ; whereas previously to bring down the same amount of coal required quite a number of trams and horses, and as many as perhaps a dozen men or boys. The canals may be said to have given the first real impetus to the development of the South Wales ports. For instance, about 1800, or shortly after, a canal running through Glamorganshire to Cardiff was fitted with a sea-lock entrance, and is working to this day.

The splendid qualities of Welsh coal became more and more known and created an ever-increasing demand. It was not long before the canals became incapable of

providing adequate means for transporting the required quantity of coal to the sea, and gradually they were replaced by railways.

Coming now to the ports themselves, it is necessary to bear in mind that the Bristol Channel has one great peculiarity in the extent of the rise and fall of the tide. At many places the difference between the height of water at high tide and low tide is not very considerable, perhaps something between 4 ft. and 12 ft.; but in the Bristol Channel the difference between the two tide levels is no less than 40 ft.! This means that in most of the natural rivers flowing into the Channel there is plenty of water at high tide, while at low tide there is little more than a trickle between two vast expanses of mud. In consequence the ships that loaded at the ports when these were in what might be called their natural state, would be waterborne at high tide, but at low tide would be resting on the mud; and this was neither convenient nor safe for loading operations.



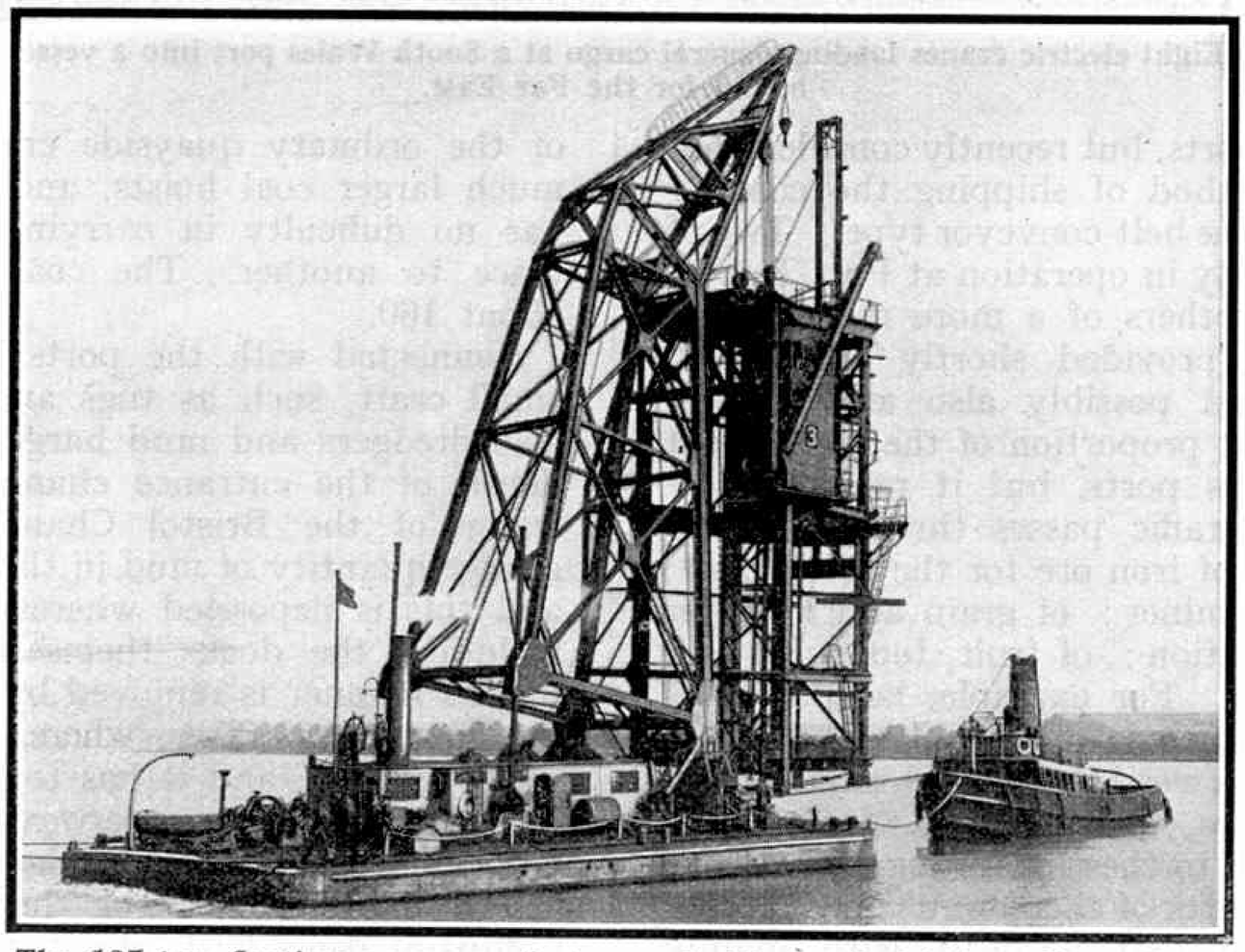
The United States liner "*George Washington*" approaching Queen Alexandra Dock, Cardiff.

The next great step in the development of the South Wales ports was to overcome this difficulty by the construction of docks to accommodate the ships that were arriving in rapidly increasing numbers to take away the coal. These docks were first contemplated somewhere about the year 1830, and we find that a dock—the West Bute Dock—was opened at Cardiff in 1839, and one at Newport in 1842. From that time there has been a steady growth of the dock system throughout the ports.

The construction of docks overcame the difficulty created by the rise and fall of the tides. The dock provides a basin of still water in which vessels can lie and be loaded or discharged at any time, but there remains the problem of transferring the vessels between the Channel and the docks, and this has necessitated the construction of entrance locks. Locks may be regarded as lifting or lowering machines that enable ships to be passed from the Channel to the dock or in the reverse direction, and their design and operation has been described in the "*M.M.*" on various occasions. In particular, the huge sea-lock at Newport, which is one of the largest in the world, is described in detail in the "*M.M.*" for August, 1930.

Even with locks, however, there must be a certain amount of water available in the tidal channel, so that the locking of vessels into dock and the locking of them out again to go to sea must take place within what is called a "range of tide"; that is, within the time of say three or four hours before and three or four hours after high water.

Each port in South Wales "grew up," so to speak, on its own account, having been promoted and constructed by separate railway or dock companies. In 1921, however, there was passed the "Railways Act," which amalgamated all the different railway companies into four big groups, of which the Great Western Railway Company is one. The Great Western amalgamation included the South Wales district, and so the ownership of these ports passed into the management of that great company, who pledged themselves to work the docks efficiently and well in the public interest, without giving preference to one port over another.



The 125-ton floating crane moving a coal shipping hoist from Town Dock to Alexandra North Dock, Newport. The immense size of the crane in comparison with the tug is very striking.

The method of dealing with the coal at the ports is interesting. The railway wagons into which the coal is loaded at the colliery belong as a rule to the colliery company, and have end doors. At the port the wagon is run into a hoist, which is really a hydraulic lift or elevator. The wagon rests on a cradle in the hoist, and the cradle is lifted. When it is at a height sufficient to be well above the side of the ship the wagon is tilted, and the end door nearest the ship opens with the weight of the coal behind it, certain catches on the door having been removed previously. The coal then rolls into a chute on the hoist, the end of this chute being in or just

over the hatchway of the hold of the vessel. In this manner the coal is guided into the proper hold, where the coal trimmers get to work on it and place it so that the ship shall be in proper "trim" and sail on an even keel.

Before the wagon actually enters the coal hoist it is weighed, and the gross weight, that is the weight of both the wagon and its contents, is recorded. After its contents have been shipped the empty wagon is weighed again before it leaves the vicinity of the hoist, and by subtracting this figure from the gross weight, the actual net weight of the coal shipped is ascertained. The hoists, by the way, are often frequently referred to as "tips."

The whole of the work just described, with the exception of the trimming on board the ship, is carried out by the Great Western Company. The weights of the wagon-loads are added together and thus the actual quantity loaded into any vessel is ascertained. So accurate are the figures arrived at in this manner that all the people who buy and sell coal that passes through the South Wales ports accept the Great Western Company's figures as representing the quantities upon which they have to pay or to receive payment.

The hoist that has been referred to is the most usual kind of machine for shipping coal at the South Wales ports, but recently consideration has been given to a method of shipping the coal by means of an appliance of the belt-conveyor type. Two of these appliances are already in operation at Port Talbot, and it is expected that others of a more modern and improved type will be provided shortly at Cardiff, Newport and Barry, and possibly also at Swansea.

Coal forms a very great proportion of the trade dealt with at the South Wales ports, but it must not be thought that no other traffic passes through. There come in huge quantities of iron ore for the steelworks; of pitwood to go to the mines; of grain and flour for the feeding of the population; of fruit, foodstuffs and many other commodities. For example, large cargoes of Jaffa oranges are received at Cardiff direct from Palestine. There is also a very large fish business done from Cardiff and Swansea, and trawlers of the most modern type bring in fish to these ports regularly every day for despatch to all parts of the country.

Another special traffic that is dealt with mainly from Swansea is that of the tinplate industry. South Wales tinplates go all over the world, and often come back to this country in huge quantities in the form of containers for fruit, condensed milk, fish, and other foodstuffs from foreign countries. Meat is also received in considerable quantities, and there are large cold stores provided for holding it prior to its despatch to the surrounding district, or to towns further inland. The great oil industry also provides business for the South Wales ports. The National Oil Refineries, whose products are familiar as "B.P.," bring their crude oil from Persia to Swansea in large "tankers," and manufacture the petrol and other products at their works in the vicinity of that port. The tankers then take the refined product out from Swansea to various parts of the world. In all, quite apart from coal, about 10,000,000 tons of various commodities pass through the South Wales ports each year.

During recent years the ports have come into some prominence in connection with passenger traffic. Some of the largest ocean liners have called at Cardiff and Swansea, bringing passengers from Canada and the United States, and embarking tourists and emigrants for those countries.

Eight electric cranes loading general cargo at a South Wales port into a vessel bound for the Far East.

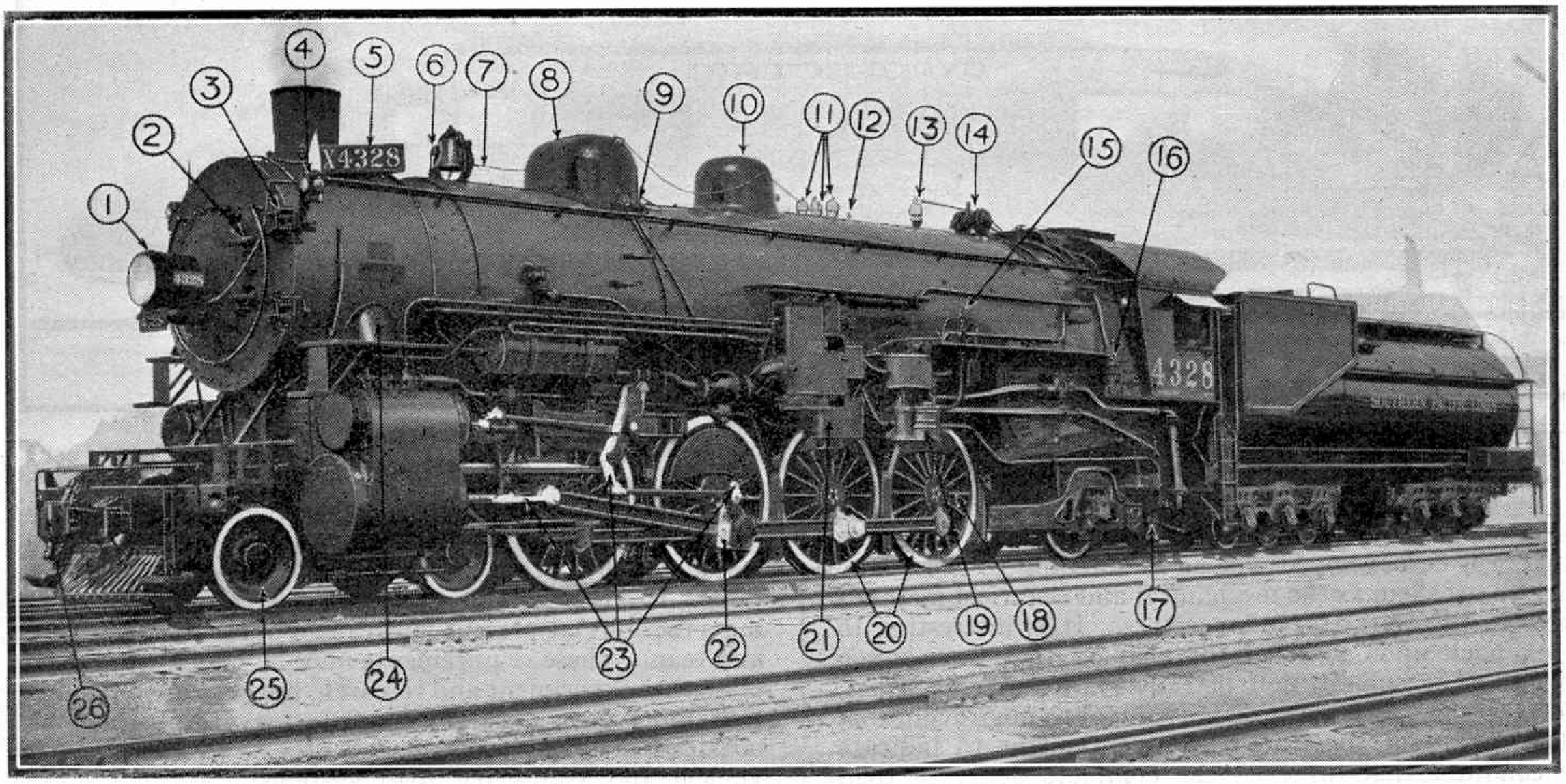
Loading and unloading of cargoes, other than coal, is done by quayside cranes operated either by water power or by electricity. Altogether about 400 cranes are in use on the quaysides at the South Wales docks, and some of them are capable of lifting as much as 70 tons. In addition there is a huge floating crane that will lift 125 tons, and this is used for handling large machinery and other specially heavy material. This crane can lift one of the ordinary quayside cranes, or even one of the much larger coal hoists, and when the need arises it has no difficulty in carrying one of them from one place to another. The coal shipping hoists number about 160.

Connected with the ports is a considerable fleet of small craft, such as tugs and barges; and there are also dredgers and mud barges to maintain the proper depth of the entrance channels and the docks. The water of the Bristol Channel carries in suspension a huge quantity of mud in the form of minute particles, and this is deposited wherever the sea water reaches, including the docks themselves. The mud deposited in this manner is removed by the dredgers and carried out into deep water, where it is dumped. This is a costly process, and it has to be carried on unceasingly in order that the waterways may be kept clear for the coming and going of the great steamers.

The dredging fleet of the Great Western Railway Company deals with about 5,000,000 tons of material every year. The fleet includes 14 vessels of various types, ranging from small grab dredgers to large bucket dredgers, the latest being a powerful vessel capable of dredging at the rate of 1,000 tons per hour. In addition, 14 steam hopper barges and 16 dumb hopper barges are employed, including three barges each having a carrying capacity of 1,000 tons.

A Fine American Engine

Southern Pacific "Mountain" Type Locomotives



The splendid locomotive shown in the above photograph is one of a class of 46 "Mountain" type locomotives built by the Southern Pacific Railroad, U.S.A., for heavy long-distance work. They were designed more especially for the run from Los Angeles, California, to El Paso, Texas, a distance of 875 miles over mountains and deserts. In the course of this run the line, which commences at about 30 ft. above sea level, rises to a height of 5,000 ft. and, at the other extreme, descends through Imperial Valley to 230 ft. below sea level.

These fine locomotives are capable of drawing a train of 13 steel passenger cars at a speed of 60 m.p.h., on the level, and of maintaining 20 m.p.h. up gradients of as much as 1 in 50. Their cylinders, 28 in. by 30 in., drive on to wheels having a diameter of 6 ft. 1 in. The boiler is 7 ft. in diameter and has a working pressure of 210 lb. per sq. in.; and the total heating surface is 6,299 sq. ft., of which the superheater tubes contribute 1,162 sq. ft. The firebox is 10 ft. in length and 7 ft. 8 in. in width. It has the large grate area of 75.66 sq. ft.

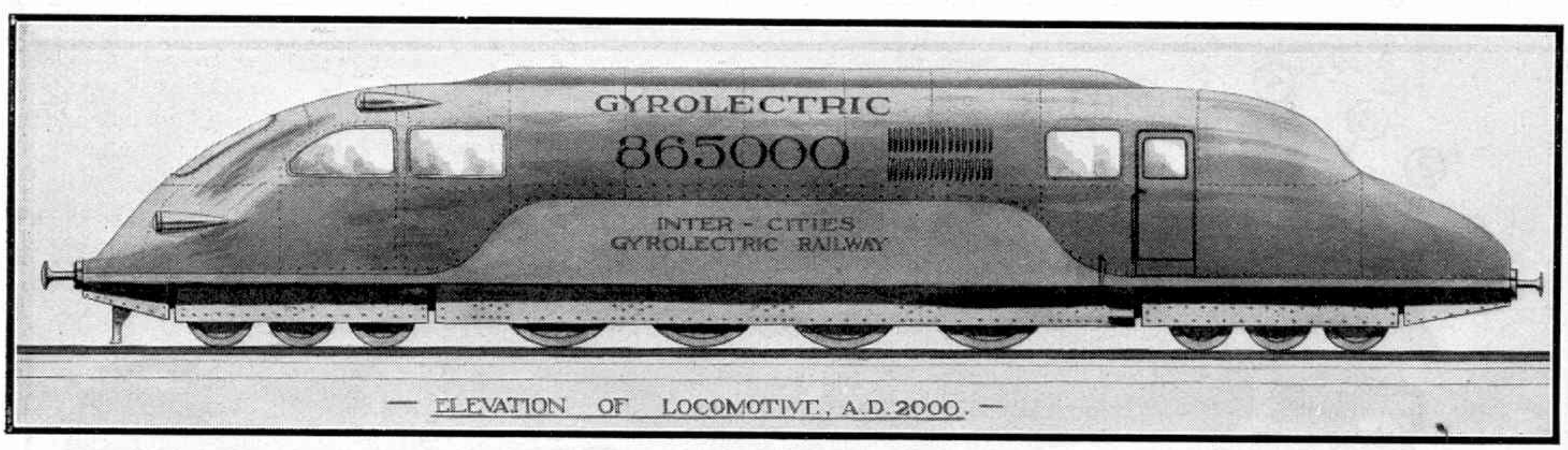
A Schmidt superheater is provided, and exhaust steam is used to heat the feed water to boiling point before it enters the boiler. Reversing and sanding are effected by compressed air, and the bell and the cylinder cocks also are air-operated. A booster is fitted on the trailing axle, and mechanical lubricators are employed. The total tractive effort of the locomotive, including the booster, at 85 per cent. boiler pressure, is 67,660 lb. Oil fuel is employed and the cylindrical tender holds 4,400 gallons of oil and 12,000 gallons of water. The total wheelbase of the locomotive is 33 ft. $5\frac{3}{4}$ in., and the total weight of engine and tender when carrying its full load of fuel and water is 614,400 lb.

Key to Numbers on Photograph Above

1. Electrically lit headlight. The beam of light is thrown three-quarters of a mile.
2. Small door swings open on these hinges.
3. Entire front swings open on these hinges.
4. Classification lamps, electric.
5. Train indicator, electric.
6. Viloco air bell ringer.
7. Steel rope to ring bell by hand.
8. Sandbox.
9. Air sander.
10. Steam dome.
11. Three $2\frac{1}{2}$ in. safety valves.
12. Valve to blow down engine.
13. Chime whistle.
14. Electric generator, steam-driven, furnishing current for lights in cab, classification lights and headlight.
15. Air pump governor.
16. Injector, one on each side in case of pump failure.
17. Booster engine.
18. Cast steel wheel centres.
19. $8\frac{1}{2}$ in. cross compound air compressor.
20. Wrought steel tyres.
21. Feed-water heater and pump combined.
22. Continuous-end main rods. The rod is a solid forging with no straps.
23. Walschaerts valve gear.
24. Outside steam pipes.
25. Wrought steel solid wheels.
26. Automatic coupler.

Transport Methods of the Future

Developments by Air, Rail and Sea

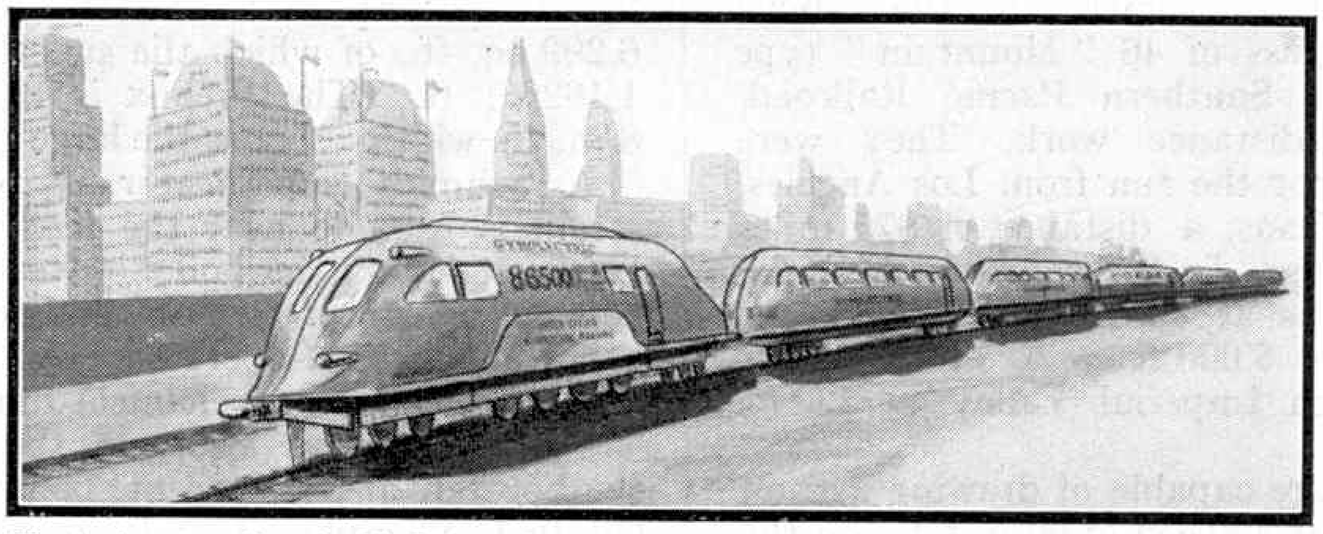


— ELEVATION OF LOCOMOTIVE, A.D. 2000. —

THE progress made in methods of transport during the past 100 years has been so great that it is difficult to believe that it can be maintained. It is probable, however, that the new methods of transport that will be developed will be as startling to those who live to see them as the mechanical and electrical methods now in use were to our ancestors. It is interesting to look back upon some of the changes that have taken place. The substitution of railways for stage coaches, for instance, was regarded as an absolute revolution. The spread of the iron road was thought to indicate a conquest that involved the complete decay of road travel; yet eventually there came a time when the development of the motor car made roads more important than they had ever been before.

Many surprises of this kind are probably in store for us. We are apt to visualise the future as bound up with the aeroplane, and to imagine that the time is coming when passengers and goods will be carried through the air almost to the exclusion of present-day methods. No doubt aeroplanes will be so greatly improved that flights round the world will be less exciting than a trans-Atlantic voyage in a 50,000-ton liner is to-day; but it is probable that greater use than ever will be made of methods of transport on land and sea, based upon those now in use.

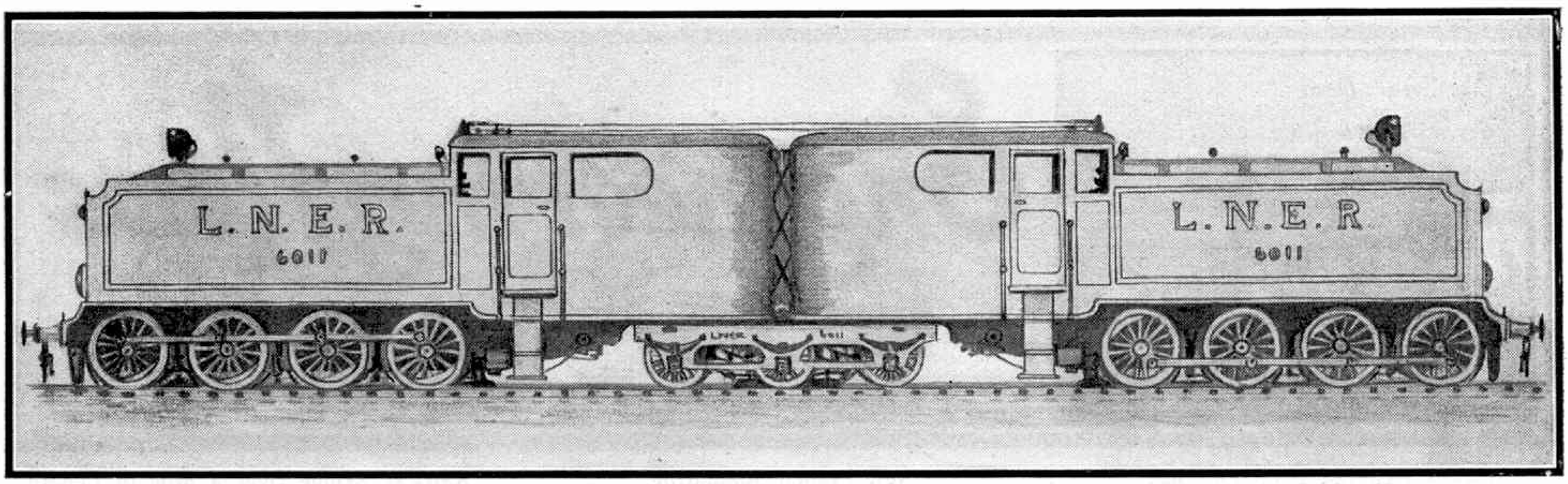
It has been suggested that some form of moving way will provide the means of travelling in the future; and that it will be possible to travel from, say, London to Liverpool, by simply stepping on to one of a series of platforms moving between the two cities like endless belts. These platforms would travel at varying speeds, in order that passengers might first board the slowest and work up to the fastest by stages that did not involve any sudden and uncomfortable increase in speed. Methods of this kind undoubtedly would prove very valuable, especially within the restricted areas of large cities; but it is doubtful whether they would ever be developed for long distance communication. They would involve the construction of enormous power plants, together with bearings and flexible joints possessing a capacity at present undreamed of for resisting wear and tear. These requirements may be met as the result of further experiment and research, but it seems probable that more economical and satisfactory results will be obtained by developments of the existing moving vehicle and stationary road systems.



(Top) A gyro-electric high-speed monorail locomotive of A.D. 2000. (Below) A train of gyro-electric monocars passing through a city of skyscrapers.

There is little doubt that rail transport will be improved enormously. The present steam locomotive, even in its most perfect form, is an extremely inefficient machine, and there is little doubt that vast improvements will be brought about either by the use of condensation or high steam pressures, or both. There may also be a tendency to abolish the double rail in favour of the single rail, with streamlined mono-cars balanced by a gyroscope and propelled by electric power.

Difficulties of transmission of power over long distances will have been overcome in one way or another by the time that mono-cars have been fully developed, and the single rail may be made to serve as a medium for the supply of electrical power to the gyroscope and to the motor that drives the car. The latter would seem absurdly small to a motorist of the present day, who is accustomed to the heavy masses of metal constituting the petrol engines, gear-boxes and back axles of the cars that now rank as the last word in engineering. But the reduction in weight brought about by the use of light alloys, and by the absence of dead weight in the shape of gearing, fuel and cooling water, will make a very small-powered motor quite sufficient to propel the mono-car

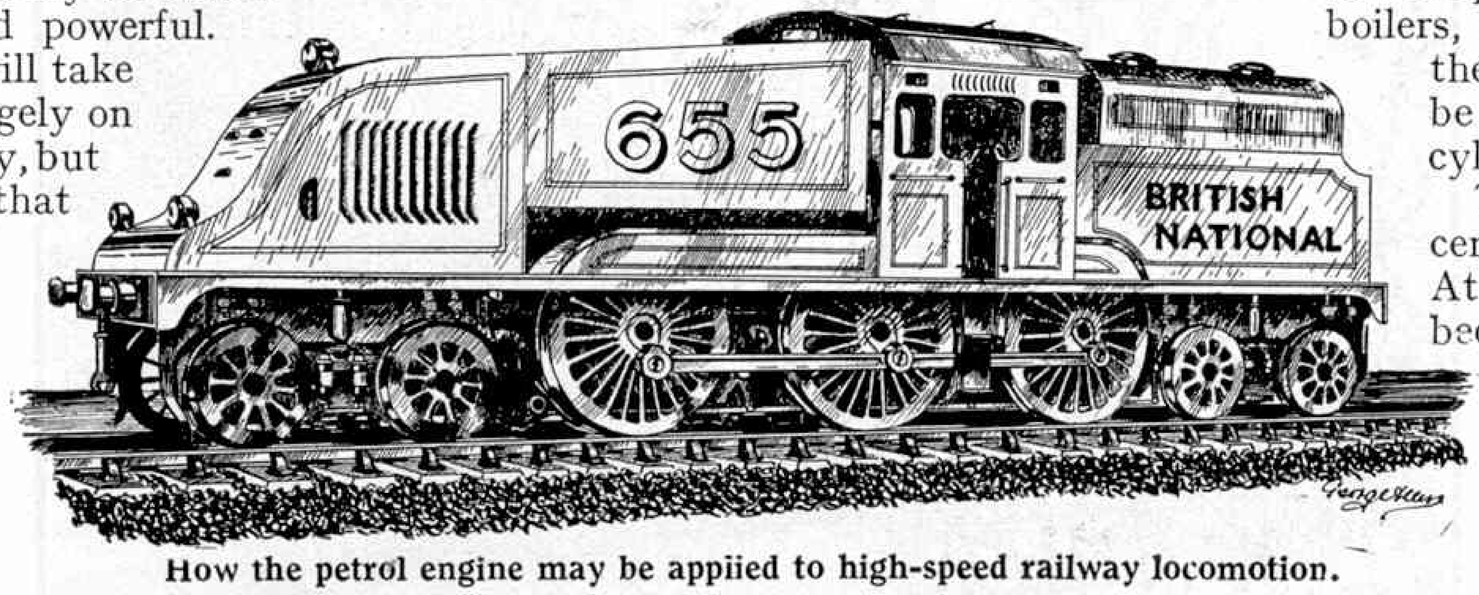


Forecast of a possible L.N.E.R. development ! A Diesel-electric locomotive of the articulated type.

of the future at high speeds.

In addition to the small privately-owned cars there will be larger ones available for public use. These will be constructed on somewhat similar lines, but extra provision will be made for the comfort and well-being of the passengers of the future who, no doubt, will examine the finest of our Pullman coaches—reposing in their museums—with feelings of surprise that human beings actually travelled in what would seem to them uncomfortable wagons that lurched and staggered at the absurdly low speed of 60 miles per hour !

Turning from land travel to transport by water, it is certain that sea-going vessels will be larger. Standardised systems of construction will no doubt be adopted to reduce their cost and the time spent in building them, while their machinery will certainly be much more compact and powerful. The exact form it will take will depend very largely on the future fuel supply, but there is no doubt that some of the steps at present existing between the source of power and the final impelling system will be either abolished or simplified considerably.



How the petrol engine may be appiied to high-speed railway locomotion.

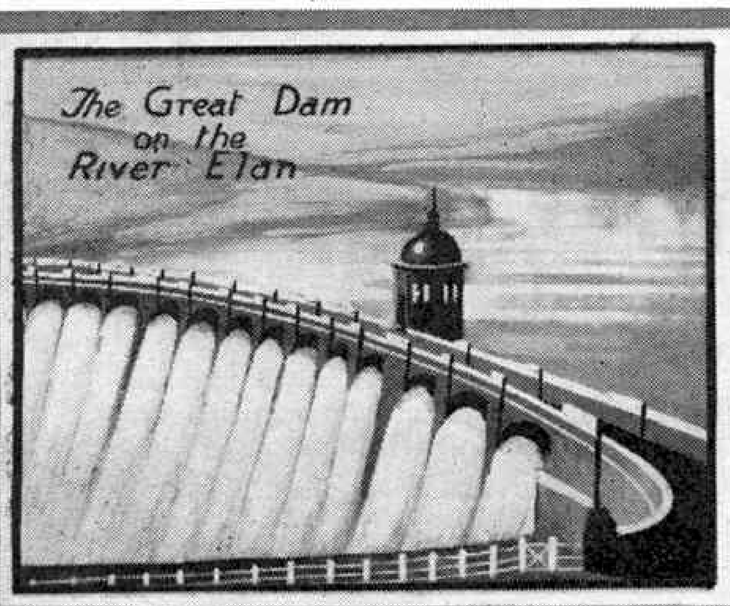
It is not altogether impossible that cables will stretch across the ocean, from which ships may pick up current to drive electric motors. Feats that were really more startling than the provision of such wires have often been accomplished by engineers in the past, and the attempt that is to be made to place a string of floating landing-stages across the Atlantic Ocean like stepping stones may eventually lead to developments of this kind. But if ships continue to run under their own power, a form of Diesel engine with electrical transmission seems likely to become prominent, and will no doubt hold its own for a considerable period.

The time is approaching, however, when oil as well as coal will fail us. The exhaustion of the supply of these important fuels is not a matter for alarm. Other sources of power will be discovered, or to make a more accurate statement, other methods of using the power derived from the Sun's heat. At present we make use of this immense source of power in a really crude and second-hand fashion. We have begun to make use of such sources of natural power as waterfalls, and probably the time is not far distant when the power of the tides and winds will also be utilised. These indirect methods of using Sun power are not wasteful, but they are somewhat capricious. In time to come more direct methods will be brought into use under the compulsion of necessity, and the total horse power that will then be available will be immeasurably greater than that with which we struggle on to-day.

In the days when we rely upon the direct heat radiated by the Sun, plants for power production will be more concentrated. Instead of myriads of little power plants, some obsolete and many inefficient, scattered over the surface of the Earth, there will be several stations distributed around the Earth on or near the equator, where the Sun's radiation is most powerful. The heat, concentrated by mirrors or lenses of super-glass, will be used to evaporate a liquid in boilers, and the pressure of the resulting vapour will be utilised in giant cylinders.

The liquid used will certainly not be water. At present water is used because it is cheap and plentiful and its boiling point is not inconveniently high. We are so thoroughly accustomed to the use of steam in engines that a suggestion to use any other liquid than water comes with something of a shock; but from an efficiency point of view better results would be obtained from mercury. This is an expensive liquid with a high boiling point, but it has nevertheless been found possible to use it on a commercial scale for power production, the vapour being condensed after leaving the working cylinders and the heat thus liberated used for steam production. Other liquids may be discovered to have thermal properties equal to those of mercury, and with greater experience in building boilers and cylinders to withstand higher temperatures, there seems little doubt that one of these will come into use instead of water.

The power produced by the great plants to be erected in the tropics must then be transmitted to other regions of the Earth. The forms in which the transmission will be made will depend very largely upon the purpose for which power is required. Electricity will certainly play a very important part, and already it is comparatively easy to transmit high-voltage current economically over enormous distances by cables. *(Continued on page 40)*



Engineering News of the Month

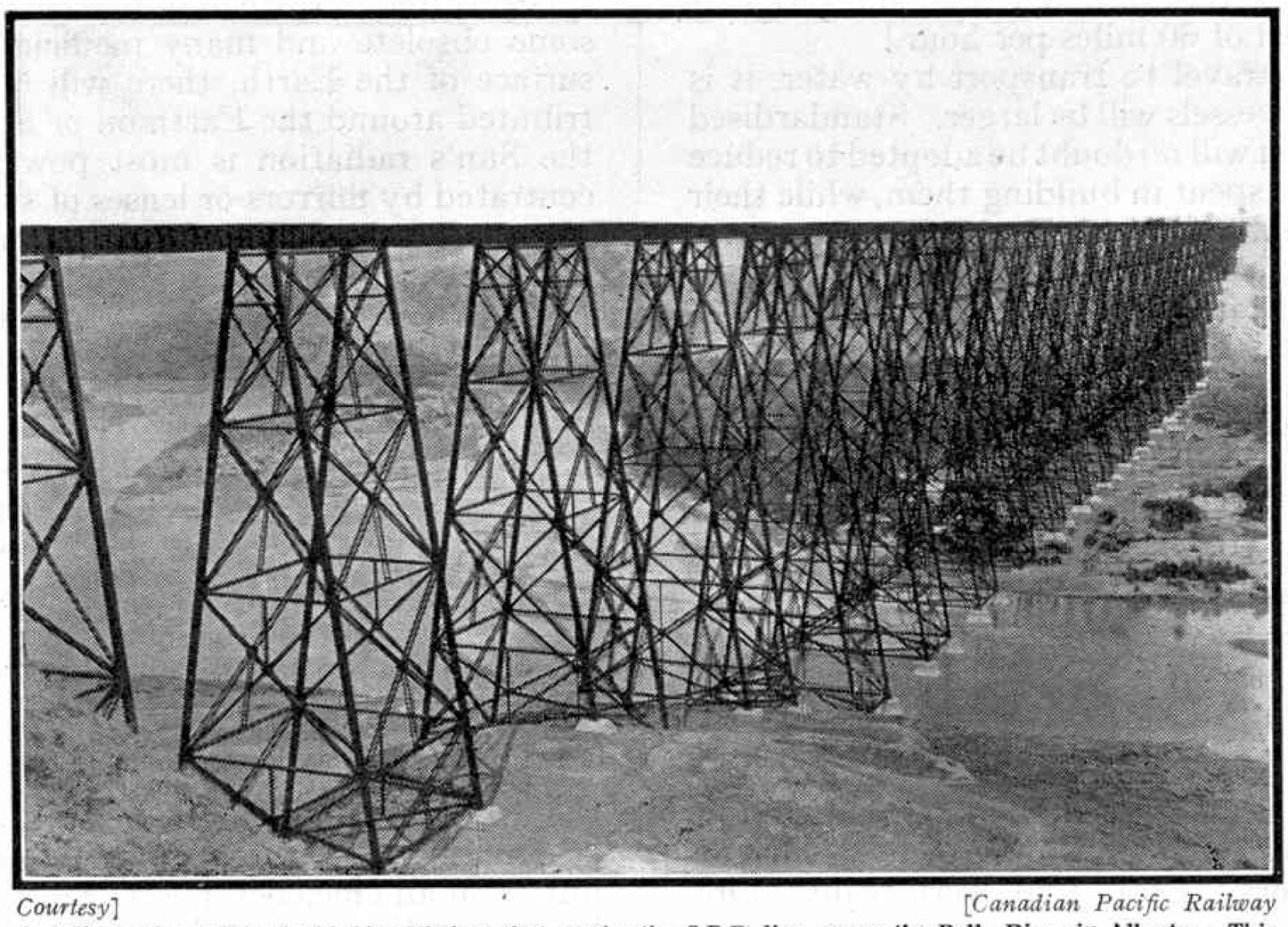
World's Heaviest Drop Forgings

A short time ago a forging weighing 1,750 lb. was made in the United States from a billet 2,000 lb. in weight. At the time it was claimed to be the heaviest drop forging ever made. It is interesting to find that for some time a Sheffield firm has regularly produced drop forgings from billets weighing 2,350 lb. that have a finished weight of 1,800 lb.

Interesting Railway Viaduct at Montreal

A unique railway viaduct is now being constructed in Montreal to carry the tracks of the Canadian National Railways to and from a great new terminal station that is to be built in the city. A contract has already been awarded for a part of the work and the construction of a portion about 2,000 ft. in length is to be commenced shortly.

The viaduct will really be a series of two-storey buildings of reinforced concrete, connected by bridges that cross important thoroughfares. The first and second floors of the structure will be available for employment as garages or warehouses and the top deck or roof will carry eight railway tracks. These will be set in rock ballast in order to protect the occupants of the concrete buildings from annoyance by noise and dust.



Courtesy] [*Canadian Pacific Railway*

A striking view of the Lethbridge Viaduct that carries the C.P.R. line across the Belly River in Alberta. This Viaduct was described on page 192 of the "M.M." for March, 1930.

Railplane for Germany

Experiments have been carried out in Germany with a car propelled by means of an airscrew. This is made of steel tubes and aluminium sheet plating, and is covered with balloon fabric. It will carry 24 persons and is driven by a 500 h.p. aeroplane engine that is connected to a four-bladed propeller mounted at the rear of the car. The invention appears to be similar to the George Bennie Railplane described on page 594 of the "*M.M.*" for August, 1930, but the German machine runs along a standard railway track and the British car operates along an elevated runway.

During tests, which were made over a stretch of railway near Hanover, the car attained a speed of 93 m.p.h. in two minutes after starting.

New French Submarine

A new French submarine was launched at Cherbourg a short time ago. The vessel has been named the "Prométhée," and it is the first of 25 submarines of the same class that have been ordered by the French Naval Authorities. It is about 295 ft. in length and has a beam of 29.5 ft. When at the surface the displacement is 1,550 tons, and this is increased to 2,000 tons when the vessel is completely submerged.

The propelling machinery of the new submarine consists of two fuel injector engines each developing 500 h.p., while two 600 h.p. electric motors are also installed. Stores and fuel for a cruising period of 30 days may be carried on board. Twelve torpedo tubes are fitted on the vessel, which also carries two large guns, one of 100 m.m. bore and the other of 38 m.m., in addition to a machine gun.

Grimsby's New Dock

A large new dock is now being constructed at Grimsby. The work is being carried out by the firm of Sir Lindsay Parkinson & Co., and the total cost is expected to be nearly £1,336,500. The dock will be about 37 acres in area and is intended for use by fishing vessels. Its construction will greatly improve the facilities already available for the fishing industry at Grimsby, where there are 29 acres of water space available for fishing boats.

Railway Bridge Over a Mile in Length

For many years specially designed ferry boats have carried the trains of the Southern Pacific Railroad across Suisun Bay, which is about 30 miles in a north easterly direction from San Francisco. These are now to be scrapped, the construction of a new bridge having made them unnecessary.

The new structure is 1⅛ miles in length and in its construction 22,000 tons of steel were used. It has seven main through spans, each 526 ft. in length, and includes a lift span that has a length of 328 ft. and is claimed to be the largest in the world. An idea of the size of the bridge may be gathered from the fact that the largest of the supporting concrete piers have bases measuring 40 ft. by 60 ft. and are 206 ft. in height. This means that they are about the same height as a 20-storey building!

The bridge has been built in 18 months at a cost of about £2,500,000, and its use will speed up passenger trains by about 30 minutes.

Britain's Greatest Power Station

Building operations at the new Battersea Power Station are now well advanced. When completed this station will be the largest in the country and will be the chief of a number of stations designed to feed the Metropolis and South East England. Eventually its capacity will be 400,000 k.w. and it will be capable of supplying the needs of half London, but the buildings for only one half of the project are now under construction.

It is interesting to note that the work being carried out will require 18,000 tons of steel and 9,000,000 bricks. Four fluted concrete chimneys are to be constructed. These will be superimposed upon towers, 200 ft. in height, situated on each side of the central boiler houses, and will rise to a height equal to that of the Cross of St. Paul's. The total cost of the project will be about £6,000,000.

The new station will supply current to both sides of the Thames, and in order to make this possible a great tunnel has been bored to carry cables below the river.

One-and-a-half Million Horse Power !

Two transformers, that for two seconds have a capacity of 1,250,000 k.v.a.—well over a million-and-a-half horse-power—have been installed at the Schenectady Works of the General Electric Company of New York. This maximum capacity is more than twice as great as that of the installation of the Niagara Falls Power Company, which is rated at about 550,000 k.v.a.

The normal rating of the transformers is 33,333 k.v.a. They are to be used for testing switch gear of various types and are the largest yet built for this purpose. The transformers will be used with a 100,000 k.v.a. generator and the two now installed are the nucleus of a bank of four.

The size of these transformers may be realised from the accompanying illustration. Each is 28 ft. 1¼ in. in height, 21 ft. 8 in. in length and 12 ft. 2 in. in width. No less than 200 gallons of oil are required to fill the case of a single transformer. This weighs about 100 tons. The weight of the core and windings is 64 tons, and the total weight of a single transformer when ready for service is slightly less than 200 tons. An interesting feature of the transformers is that on top of each are 13 high voltage bushings. This number is employed in order that different voltages may readily be applied to the various types of switch gear under test. The transformers were manufactured at Pittsfield, Massachusetts, and were transported to Schenectady, where they are to be employed, in cars that were heated to a temperature of 90°F. This temperature was maintained throughout in order that the cores should not absorb moisture during transit.

Huge Oil Storage Depôt for Thames

Work has now been started on a large oil storage and refinery depôt that is being built on the Thames in the south west corner of Canvey Island. The depôt will have a river frontage of 2,300 ft. and its total area will be about 197 acres. The initial storage capacity is expected to be about 100,000 tons, and this will probably be doubled within six months.

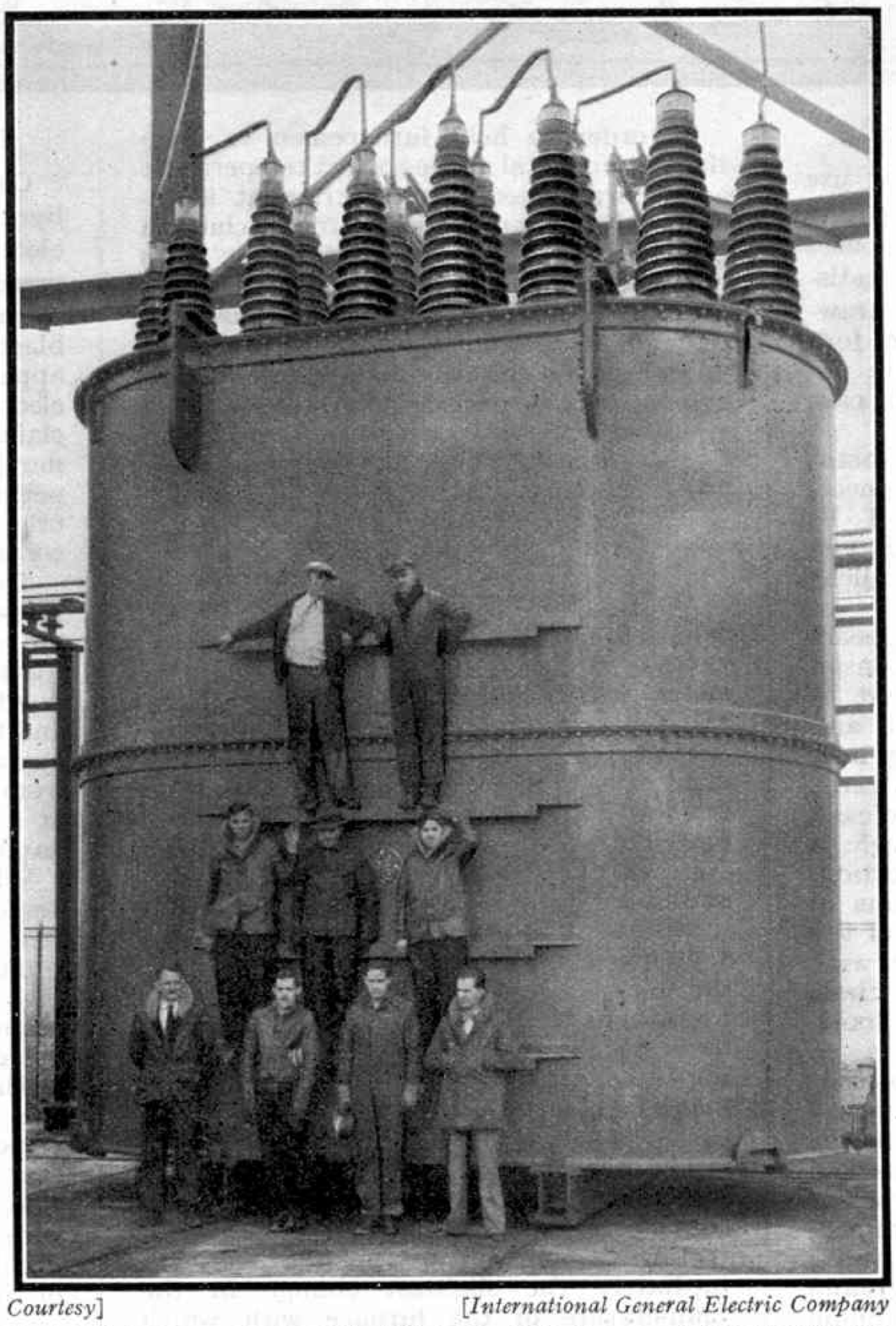
Three jetties are to be constructed for the accommodation of oil-tankers. At the quaysides there will be a depth of water of 33 ft., and if the necessity arises this may be increased by 7 ft. The largest oil tankers at present using the Thames therefore will be able to lie alongside the depôt.

Developments in the Grampian Electricity Scheme

The engineers in charge of the Grampian Electricity Scheme, have now decided to make use of the waters of Loch Rannoch in addition to those of Loch Ericht. This will necessitate the damming of the River Tummel and the formation of a shallow lake that will extend for about three miles up the Tummel valley. A canal will then be constructed from the dam to Tummel-bridge, which is about three miles away and is the proposed site of a second power house. This canal will be about 10 ft. in depth, and 16 ft. in width at its base. Its width at the top will be 40 ft.

Submarine Built 300 Miles from Sea

The contract for the construction of a new submarine for the French Navy was recently secured by a shipbuilding firm whose yards are situated at Chalôn-sur-Saône, which is 300 miles from the coast of the Gulf of Lyons. It had been intended that the submarine should make its way to the Mediterranean Sea under its own power, but when the vessel had been constructed it was found that this was impossible owing to the shallowness of the River Saône.



Courtesy] [*International General Electric Company*

A giant transformer that weighs 200 tons. This is one of two transformers that have been installed for testing purposes at Schenectady, U.S.A., and are described on this page.

In order to get over this difficulty a floating dock was constructed. This differs from the well-known docks employed at Southampton, Singapore and other ports only in size and in having closed ends. When the dock was ready the submarine was placed inside and firmly braced in position in order to prevent movement during the journey down the river. On reaching the sea the carrier was submerged and the submarine floated off.

South Africa's First Trolley Omnibus

An electric trolley omnibus that was taken to South Africa for demonstration purposes a short time ago, is the first vehicle of this type to be seen in that country. The machine is of British make and is of the six-wheeled double-decked type. Its weight is only 8½ tons, and it is claimed that the total running costs are only 1½d. per mile. It is hoped that several orders for similar vehicles will be placed in this country.

Dam Blown into River by Dynamite

An entirely new method was adopted in the construction of a dam across the Saguenay River, an important waterway in the province of Quebec, Canada, that is being utilised as a source of hydro electric power. The dam was built on concrete piers at the edge of the river and then toppled into position by blowing up one of the piers with dynamite.

A gorge at a point on the river called Chute-á-Caron was the scene of this remarkable operation. There the Saguenay River is deep and runs very swiftly, the flow varying from 35,000 c. ft. to 225,000 c. ft. per second. At first it was proposed to build a dam in the ordinary manner by erecting timber cribs kept in position by heavy weights and a canal was dug in order to divert a proportion of the water from its usual course. It was found that the river was still too deep and turbulent for this plan to be adopted, however, and after a careful study of the conditions Mr. J. W. Rickey, hydraulic engineer of the Aluminium Company, the builders of the dam, decided that the only means of getting the structure into position was to drop it ready-made into the river. He suggested that a heavy reinforced concrete tower of the size of the dam should be built on two piers on the river bank, and that the support nearer the river should be blown away in order to allow the tower to fall into the gorge.

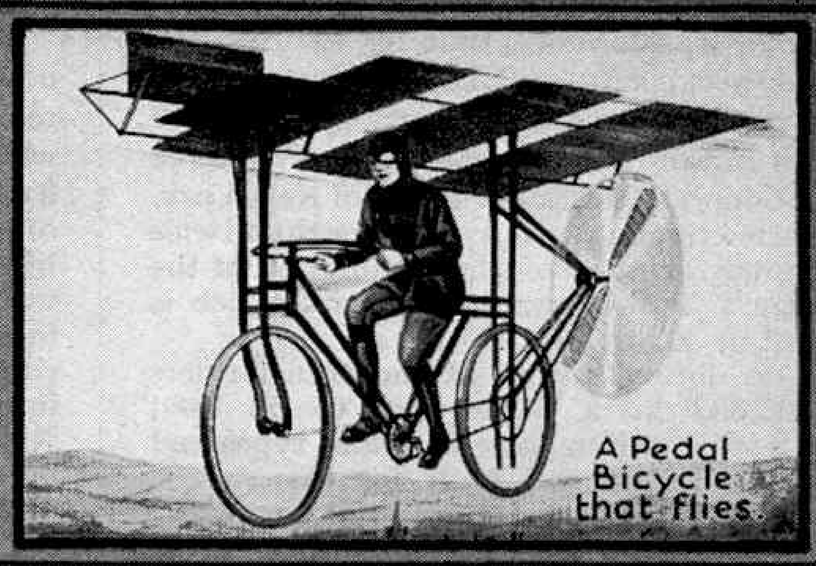
Before any further steps were taken Mr. Rickey prepared scale models of the gorge and of the proposed tower, and with them he carried out a trial of the plan he proposed. Moving pictures were taken and these were carefully studied with the aid of a projector.

As a result of this experiment it was decided that the scheme was feasible, and the tower was constructed at the side of the proposed dam. The block of concrete was 92 ft. in height and 45 ft. in width, and the side that was to lie at the bottom of the river was shaped to fit the contours in which it would rest. A certain amount of the water flowing down the river was diverted into the canal and the moment awaited when there was just sufficient left on the site of the dam to act as a cushion for the falling mass of masonry. When all was ready the charge of dynamite inserted in one of the piers was detonated. The concrete mass then toppled over into the gorge and settled in practically the exact position required.

Giant Plate-Bending Press

A huge steel bending press has been made in Germany for work on a new cruiser on which certain parts are to be made of steel plate instead of the more usual cast steel. The press is claimed to be the largest in the world, and is capable of exerting a pressure of 1,000 tons, although normally it operates at from 400 tons to 800 tons. The machine is fitted with a hydraulic intensifier which has an ample margin of strength. When a test load of 1,000 tons was applied the pressure of the liquid employed in the hydraulic gear reached 3,550 lb. per sq. in.

OUR BUSY INVENTORS



A More Efficient Form of Castor

The ordinary type of castor for use on the many types of trucks and racks employed in factories and warehouses cannot be described as an entirely satisfactory device. One of its chief drawbacks is that the top plate and the fork are connected by means of a centre pin that may break or bend, in each case with disastrous results.

These troubles are avoided in a castor that has been designed on sound engineering lines by Dr. Hele-Shaw and Mr. T. E. Beacham. This is called the Revvo Castor, and in trials has given excellent results.

An illustration of the new castor appears on this page. It will be seen to consist of two parts—a fixed portion that is attached to the truck to be carried, and a swivelling section, the two being held together by a single row of balls in races that give four points of contact for each ball. The balls are loaded through a hole in the side of the swivelling portion, this afterwards being filled by means of a pin suitably secured. The wheel of the castor is strongly made, and the wide tread is machined to an arc of a circle in order to avoid damage to wood floors.

With the Revvo castor there is no upsetting movement, as the point of contact of the wheel with the floor is well inside the radius of the ball circle in the swivelling section. The balls are packed in grease and a swivelling movement with practically no friction is obtained. The castor is made in several sizes and a special form with very small ground clearance is made for use where a minimum overall height is essential.

Machine-Gun to Fire Thirteen Miles

An amazing machine-gun has been designed and constructed by an American inventor. It is claimed that from it bullets may be fired at the rate of 800 per minute, and that the range of fire is thirteen miles. The bullets employed in this gun are of the 1.1 explosive type.

Mr. R. Hudson, the designer of this gun had already produced a similar gun with a range of nine miles, but an even greater achievement is his invention of an anti-aircraft gun that fires .3 calibre bullets at the rate of 1,400 per minute.

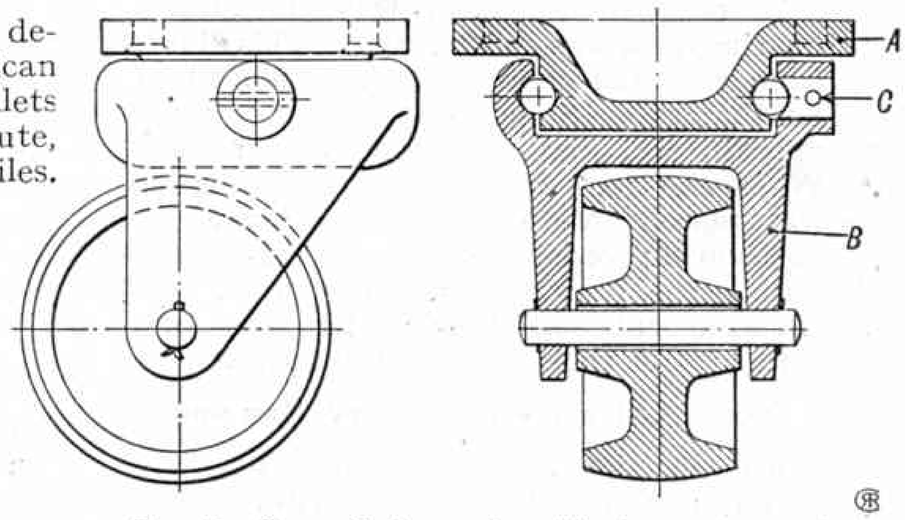
"Electric Eye" to Measure Temperature

It is estimated that in the United States alone several hundred thousand tons of steel are scrapped annually, or sold as an inferior product, because during its production the temperature has been too high. If steel is overheated its properties are completely changed, and it may become quite useless for certain purposes.

In order to help furnacemen to keep the molten metal at the correct temperature an accurate measuring instrument is required. For this purpose one that includes a photo-electric cell, or "electric eye," has now been developed by the Westinghouse Electric Company. When it is exposed to the radiations from the furnace a current flows between the two electrodes in it, and this current is measured by means of a galvanometer. This instrument is calibrated in degrees, and thus shows at a glance the temperature to which the steel is being subjected.

The Revvo Castor, designed by Dr. Hele-Shaw and Mr. T. E. Beacham. For the illustrations of this new form of castor we are indebted to the Revvo Castor Co.

The new instrument is capable of detecting immediately the slightest change in the temperature of the furnace with which it is used, and thus it gives warning that steps must be taken to correct any deviations that may result in the production of inferior metal. It is believed that its general adoption throughout the United States would result in the saving of sufficient steel every hour to construct the frames of 20 buildings of the size of the largest skyscraper in New York.



How the Revvo Castor works. The two parts are held together by a row of balls instead of by a pin.

Direction Signals for Steam Boats

Considerable interest has been aroused by the introduction of a new system of electric signals for use on ships. At present pilots and navigating officers give warning of their intentions by means of blasts on the ship's sirens. In the new apparatus signals are given by means of electrically illuminated arrows, and it is claimed that with their aid the intended movements of a vessel may be made perfectly clear to the officers in charge of other ships. Thus risk of collision is considerably decreased.

Three illuminated arrows are used. These are about 8 ft. in length, and they are arranged in a prominent position in front of the bridge. The outer arrows point to port and starboard respectively, and that in the centre is directed vertically upward. Their illumination is controlled from the bridge and the signals are visible at a considerable distance even in broad daylight.

When a vessel fitted with the new device is about to turn to port or starboard the corresponding arrow is illuminated, while the central one is used to indicate that the course to be followed is straight ahead and that signals from approaching vessels are desired.

The first vessel to which the apparatus was fitted was the "*Batavier V*," a vessel owned by a Dutch Shipping Line that plies between London and Rotterdam. The directors of the line are so satisfied with the results obtained that they have decided to equip the remaining vessels of their fleet in a similar manner.

Easily Operated Spare Wheel Carrier

An interesting invention that saves drivers of heavy lorries much heavy lifting is a spare wheel carrier that now may be fitted to a six-wheeled lorry. The space for the spare wheel is at the rear of the driving cab, and in it fits a framework to which the wheel is attached by means of a false hub and spindle. The entire framework is pivoted on an axis at the side of the lorry and may be turned by means of a pinion and toothed quadrant.

When replacement is necessary the driver simply turns a handle. This causes the framework carrying the wheel to swing over until the free end rests on the ground, and the wheel then may be released.

The effort required to load or unload a wheel is very small, but although a great mechanical advantage is obtained, very little time is lost in carrying out the operation. It is claimed that less than a minute suffices for putting a wheel into the carrier or for removing it. In addition, there is no difficulty in fixing a framework on each side of a lorry, thus enabling two spare wheels to be carried.

Revolutionary Motor Car Inventions

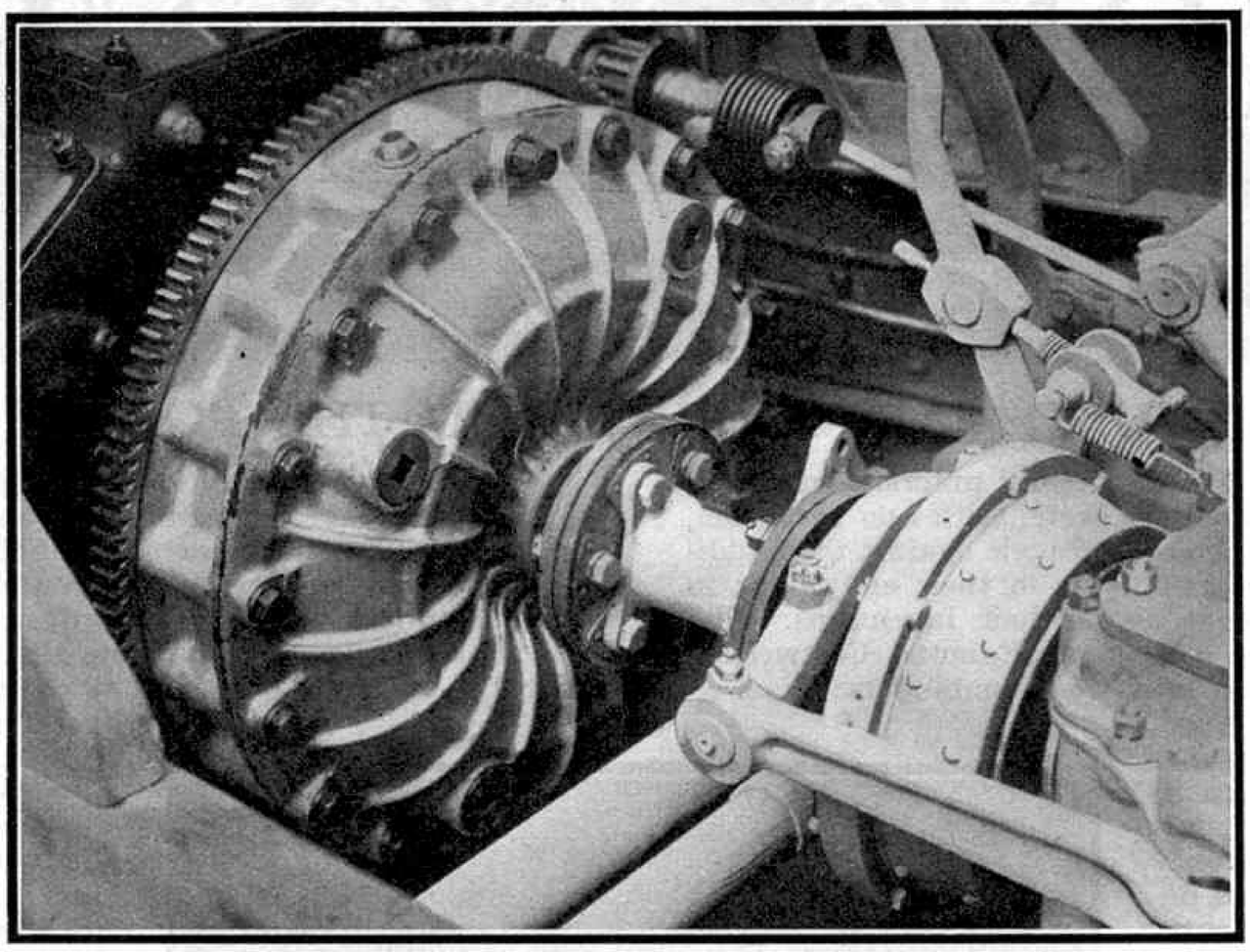
An invention that promises to bring about revolutionary changes in motor car engineering is the Daimler Fluid Flywheel. A car equipped with this interesting mechanism may be started by simply pressing down the accelerator pedal and in order to bring it to a standstill it is only necessary to use the footbrake. Gear changing is practically unnecessary. There is no risk of stopping the engine by a sudden application of the brakes while driving through traffic, and on restarting the car glides away with certainty and perfect smoothness.

The Daimler Fluid Flywheel, the use of which makes car control so easy, may be described as a clutch in which oil is used to transmit the drive. It consists of two parts, a cylindrical driving member connected to the engine and a driven member enclosed within the first. Both sections are saucer-shaped. Webs divide them into a large number of cells, and between them is a small gap.

When the car is travelling at ordinary speed, the oil with which the clutch is filled is carried round the driving member and takes the second round it, the movement being transmitted to the road wheels. On releasing the accelerator pedal and applying the footbrake, when the speeds of the engine and of the car are reduced, a certain amount of slip takes place within the flywheel. This slip becomes practically complete when the number of revolutions per minute falls below 600. Then with the engine running slowly and the gears engaged, the car remains at a standstill. In order to restart it the speed of the engine is increased. The two parts of the clutch then begin to take a grip of the oil, the amount of slip rapidly diminishes as the speed rises, and the car slowly and gently begins to move.

On cars fitted with this remarkable invention gear changing is seldom required. In order to enable it to be carried out when necessary—as in ascending steep hills, for instance—an ordinary friction clutch is fitted between the Fluid Flywheel and the gear box. This has very little work to do. It is therefore smaller and lighter than usual, and with it gear changing is exceptionally easy.

Even the small amount of trouble given by gear changing in cars fitted with the Fluid Flywheel is avoided when a "self-changing" gear box also introduced by the Daimler Company is used in conjunction with it. This is quite silent in action and is operated by means of a small hand lever mounted on the steering wheel. This is called the preselector gear lever and may be placed in position to engage any desired gear before the actual moment when it is wanted. Pressing down a pedal and releasing it completes the operation, and no clutch or clutch pedal is required. Thus the employment of the two devices makes driving a motor car a simple task.



Courtesy] [*Daimler Co. Ltd.*

The Daimler Fluid Flywheel, described on this page. The driven member of this revolutionary invention is enclosed within the flywheel. On the right may be seen the small friction clutch used when gear changing is necessary.

Defeating the Educated Burglar

The use of a ray of light to protect safes and objects of value became familiar last year, when exhibits of jewelry in London were protected by a beam of invisible infra-red light. This was projected on a photo-electric cell in such a manner that anyone approaching the exhibit interrupted the beam. The effect of this was to cause the cell to bring into operation an electric relay that rang a warning bell.

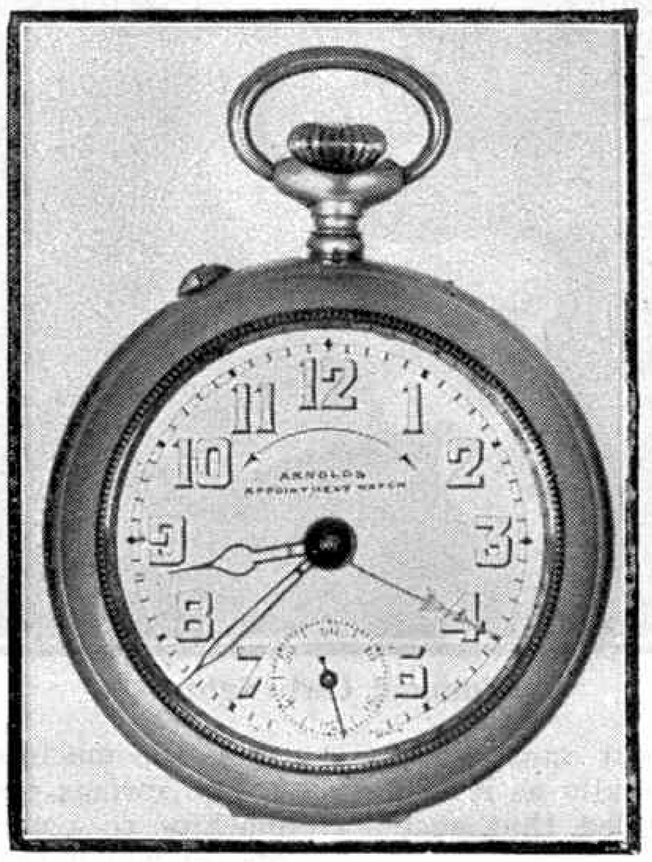
With alarms worked in this manner, and in which ordinary light or infra-red light is used, there is always the possibility that a scientifically-minded burglar would provide a second beam of light, and by directing this on the photo-electric cell at the moment when he interrupts the one installed he would prevent the device from giving warning of his presence. The light of an electric flashlamp would be sufficient in those cases where protection is by means of a ray of visible light, and there is a sufficient proportion of infra-red light in certain electric lamps of the ordinary type to keep in operation a projector depending on radiation of this character.

This difficulty has been overcome by using ultra-violet light of low wave length. Light of this kind is invisible and it is difficult to devise any portable apparatus for its production.

In an alarm devised by the Westinghouse Lamp Company a photo-electric cell is connected to an anode tube. Immediately the protecting beam is interrupted, the anode tube begins to glow, and in doing so energises a relay that sounds a gong and switches on lights. The alarm continues to sound until it is turned off by means of a hand switch.

In addition to sounding an alarm the interruption of the beam of invisible light may be made to start the mechanism of a tiny gramophone and the burglar may be greeted by loud threats to send for the police or ordered to surrender under penalty of being shot. A more peaceful application of this principle is made in a New York museum. As soon as they step out of the lift that gives access to this, visitors hear a voice inviting them to register their names. They look round to see who is speaking and are surprised to see nothing but a little box. The voice actually comes from this, for on entering they cut across the beam of invisible light and so start the rotation of a gramophone disc on which the request has been recorded.

The photo-electric cell is now used for counting the number of vehicles passing a given point, every interruption of a beam of invisible light being recorded on an electrical counting mechanism.

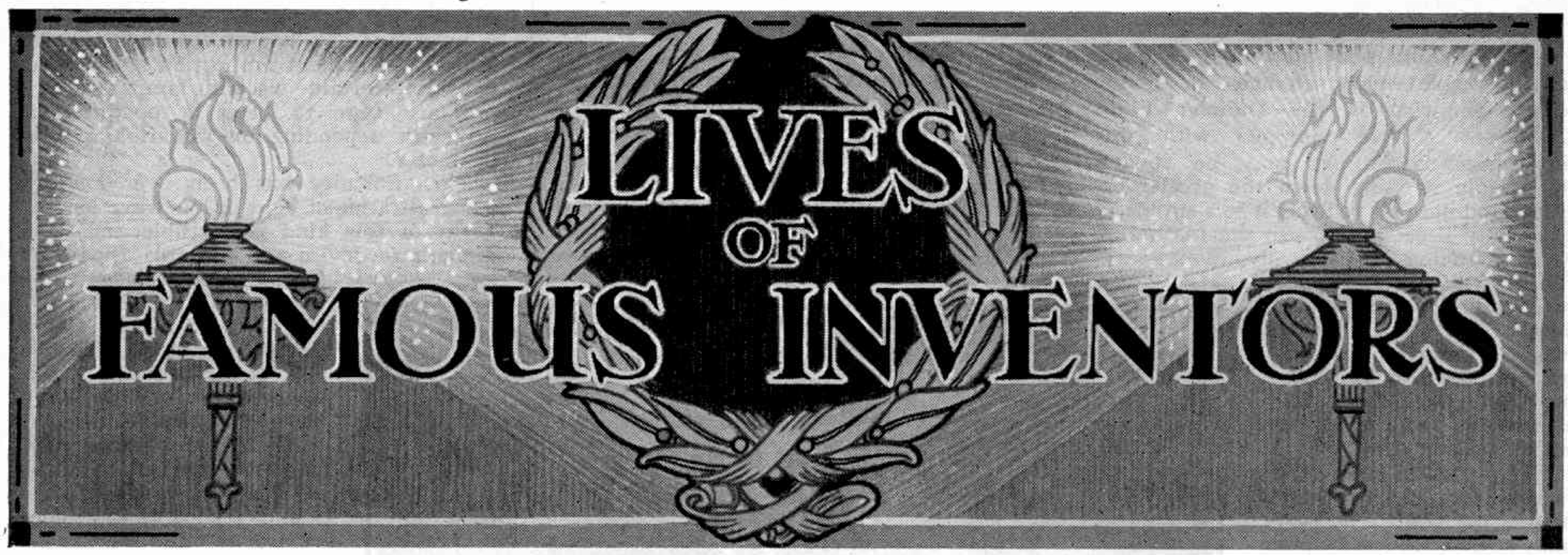


The watch shown above is fitted with an alarm that may be set to go off at any required time. It is particularly useful as a reminder of an approaching appointment, and it may be carried in its owner's pocket, or stood on a desk.

An Appointment Alarm Watch

An alarm watch has been introduced that is particularly useful to the busy man who requires to be reminded of engagements. The alarm can be set to go off at any required time, and as its vibrations may be felt by its owner when it is reposing in his pocket, he is forcibly reminded of an approaching appointment, although other noises may prevent its ring from being heard. The back of the case is hinged in order to enable the watch to be stood on a desk with its face easily visible. When in that position the table acts as a sounding board and the noise of the alarm is very readily heard.

On one winding the watch runs for 30 hours and the same operation sets the alarm mechanism, one winding knob being provided for both springs. The alarm hand may be adjusted to any desired time by means of a projection on the face of the watch, which is connected to a knurled rim. One form of the watch is provided with luminous figures and hands in order that the time may be read with ease at any hour of the day or night.

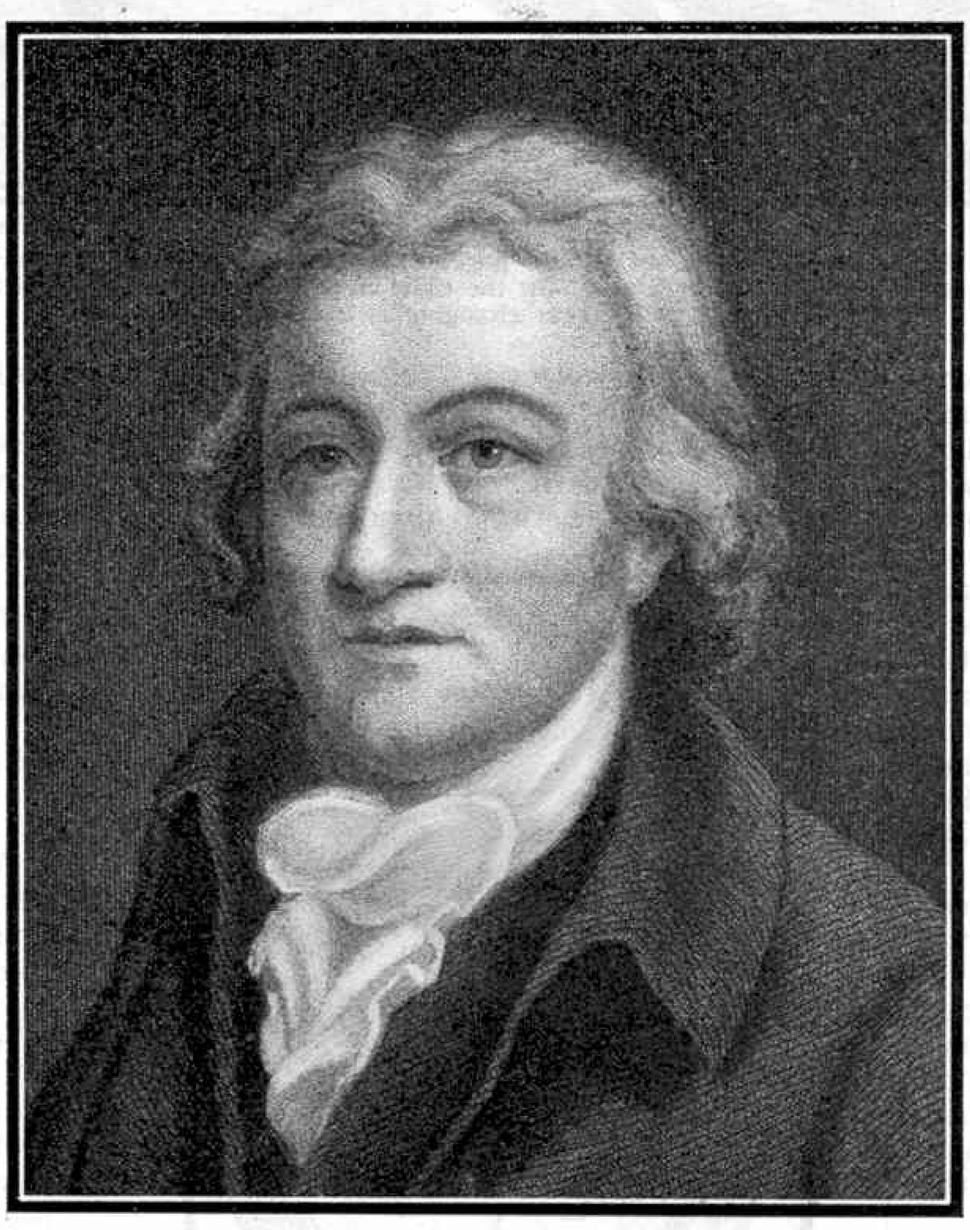


XV.—EDMUND CARTWRIGHT AND THE POWER LOOM

THE inventors who evolved the first really practical machines for spinning and weaving cotton were, with one exception, men of humble birth, who had to struggle against the handicaps of poor education and lack of funds in their endeavour to gain public recognition of the value of their inventions. The exception referred to was the clergyman Edmund Cartwright, inventor of the power loom and of a wool-combing machine.

Cartwright was born on 24th April, 1743, at Marnham in Nottinghamshire. It is said that his early inclinations were towards joining the Navy, but as two of his brothers were already intended for that service it was decided that Edmund should enter the clerical profession. He was educated at Wakefield Grammar School and at University College, Oxford, and after being ordained he held clerical appointments in various parts of the country. While he was at Oxford, and also in later life, he found time to cultivate a talent for poetry, and some of his works had a considerable sale.

It is interesting and indeed remarkable that until he was more than 40 years of age Cartwright does not seem to have been aware that he possessed any mechanical ability. The manner in which his genius for invention was stirred to action is interesting. During a visit to Matlock in the summer of 1784 he happened to enter into conversation with a group of Manchester men. The talk centred mainly upon new and ingenious inventions, and naturally led up to Arkwright's then recently-invented method of spinning cotton by machinery. One of the party remarked that as soon as Arkwright's patent expired mills would be erected in such numbers that a great deal more cotton yarn would be spun than could be dealt with by hand loom weavers. Cartwright replied that Arkwright must then devise a loom that could work up the yarn as rapidly as it was produced by the spindle, but the others all agreed that such an invention was impossible.



Edmund Cartwright.

In the "*M.M.*" for November last, in dealing with John Kay and the invention of the fly shuttle, we described the hand loom. This was a machine in which longitudinal threads called "warp" were interwoven by transverse threads called "weft," by passing the weft thread from a shuttle between certain of the threads of the warp. This was accomplished by three distinct operations—the opening of the warp, the interweaving of the weft, and the pressing of the weft into position. The most laborious feature of the process was the necessity of throwing the shuttle backward and forward by hand. This labour was abolished when John Kay invented his fly shuttle in 1733, and thus an important step was taken towards the evolution of a power loom.

Cartwright had never seen a hand loom weaver at work, but he felt that it should be possible to invent a machine to weave mechanically. He was so confident about this that he set about to devise a power loom, employing a carpenter and a smith to carry out his ideas. Unfortunately neither drawings nor models of his early attempts now exist to indicate the lines upon which he worked; but it is known that his ignorance of mechanics, together with the rough workmanship of his men, led to many mistakes being made before a workable machine was devised. The task that he had set himself completely absorbed his thoughts. During the period in which he was thinking out a method of mechanically throwing the shuttle, his children used to be greatly amused by watching him walking up and down the room lost in thought, and every now and then throwing his arms from side to side in imitation of the action of a weaver throwing the shuttle.

After nearly a year of labour Cartwright completed his first power loom, and his own words in regard to it are worth quoting. "As soon as the machine was finished," he wrote, "I got a weaver to put in the warp, which was of such material as sail-cloth is usually made of. To my great delight a piece of cloth, such as it was, was the produce. As I had never before turned my thoughts to anything mechanical, either in theory or practice, nor had even seen a loom at work, or knew anything of its construction, you will readily believe that my first loom was a most rude piece of machinery. The warp was placed perpendicularly; the reed fell with the weight of at least half a hundredweight, and the springs which threw the shuttle were strong enough to have thrown a Congreve rocket. In short it required the strength of two powerful men to work the machine at a slow rate, and only for a short time."

The springs operating the shuttle were connected beneath the machine to a cylinder that also imparted motion to two levers, one of which reversed the threads of the warp while the other lifted the reed, which subsequently descended again by its own weight. The warp was kept in tension by weights suspended from the beams, as in the hand loom.

"Conceiving in my great simplicity," continued Cartwright, "that I had accomplished all that was required, I then secured what I thought a most valuable property by a patent 4th April, 1785. This being done, I then condescended to see how other people wove; and you will guess my astonishment when I compared their easy mode of operation with mine."

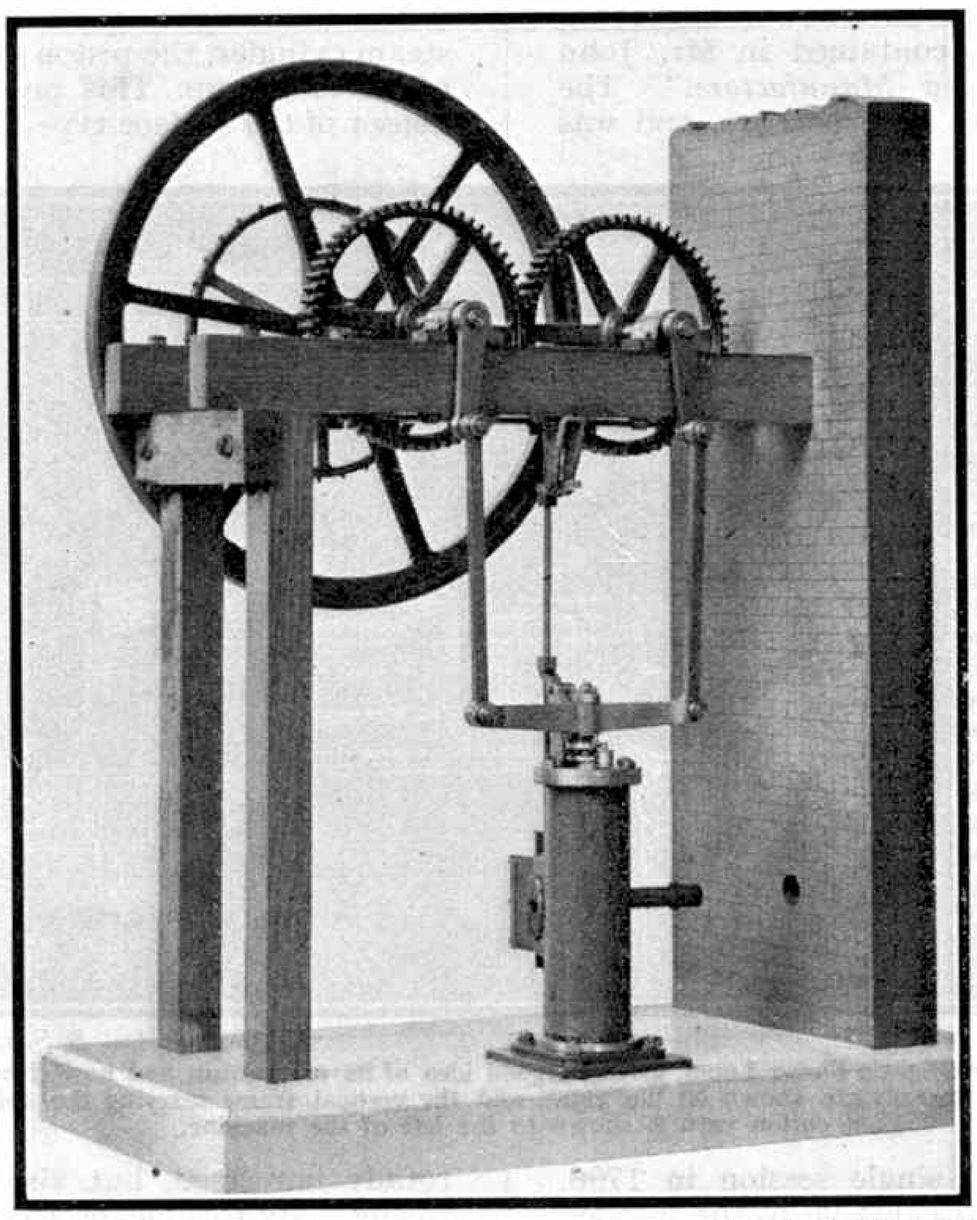
Early in 1786 he engaged some skilled workmen in Manchester to assist him to construct a more perfect machine, and later in the year he visited the city to see how the work was progressing. In a

letter to a friend he mentions some of the difficulties that confronted him at this stage. "When I arrived at this place," he wrote, "I found my machine not even begun upon; indeed, the workmen who had undertaken it, despaired of ever making it answer the purpose it was intended for, and therefore, I suppose, were not willing to consume their time upon a fruitless pursuit. I have, however, the pleasure to tell you, that the whole system of it is now finally adjusted, and so much so, both to mine and the workmen's conviction, that we cannot entertain the shadow of a doubt respecting its success. . . . I cannot forbear telling you, that the machine is so exceedingly simple and cheap as not to cost (after the model is once made to work) above five or six pounds."

Cartwright subsequently made many improvements in his loom, and patents in respect to various forms of his invention were obtained in 1786, 1787, 1790 and 1792. On page 18 is a diagram of part of the loom patented in 1790. In this machine the warp was placed horizontally, and the alternate motion of the lathe or frame A, carrying the reed, was achieved by means of the crank B, on the axis of which was mounted a gear wheel that meshed with a larger wheel carried on the driving shaft shown at the foot of the diagram. This shaft also carried two tappets *m*, shaped and mounted as shown, which actuated the treadles *n*; these were connected by means of strings *b* with the picker *a*, a device at each end of the box in which the shuttle moved. As the tappets rotated they gave an impulse to the picker, first at one end and then at the other, causing it to throw the shuttle from side to side with greater accuracy than was possible by hand. The worm wheel *o* shown at the left-hand end of the driving shaft gave motion to the callendar rollers that wound off the woven cloth. One of the most important features of the machine was an apparatus for stopping it immediately when either a warp thread or a weft thread broke. This device operated with great accuracy.

Cartwright endeavoured to interest the cotton mill owners in his invention, but they would have nothing to do with it. He was determined that its efficiency should be demonstrated, however, and for this purpose he established a weaving and spinning factory at Doncaster in 1786. He began with 20 looms, 10 for producing muslin, eight for cotton, one for making a fabric known as coloured check, and one for producing sail-cloth. The plant was worked by a bull until 1788 or 1789, when a Watt steam engine was installed.

With the establishment of his Doncaster mill Cartwright began to experience something of the persecution that had been the lot of earlier pioneers of textile machinery. Malicious reports of his activities in mechanics were circulated, and he was denounced for engaging in an occupation unsuited to his profession instead of confining himself to his work as a minister. Attempts were made to bribe his workmen and to render his machine-woven goods unpopular. The woven fabrics that he had to send elsewhere to be printed were frequently rendered unsaleable by bad workmanship and the use of obsolete patterns, and his lack of business experience involved him in many avoidable expenses. The frankness with which he communicated his ideas to others opened the way for unscrupulous persons to imitate his machine, and finally he found himself involved in protracted disputes and costly lawsuits in the effort to protect his invention.



Courtesy] [*Board of Education*

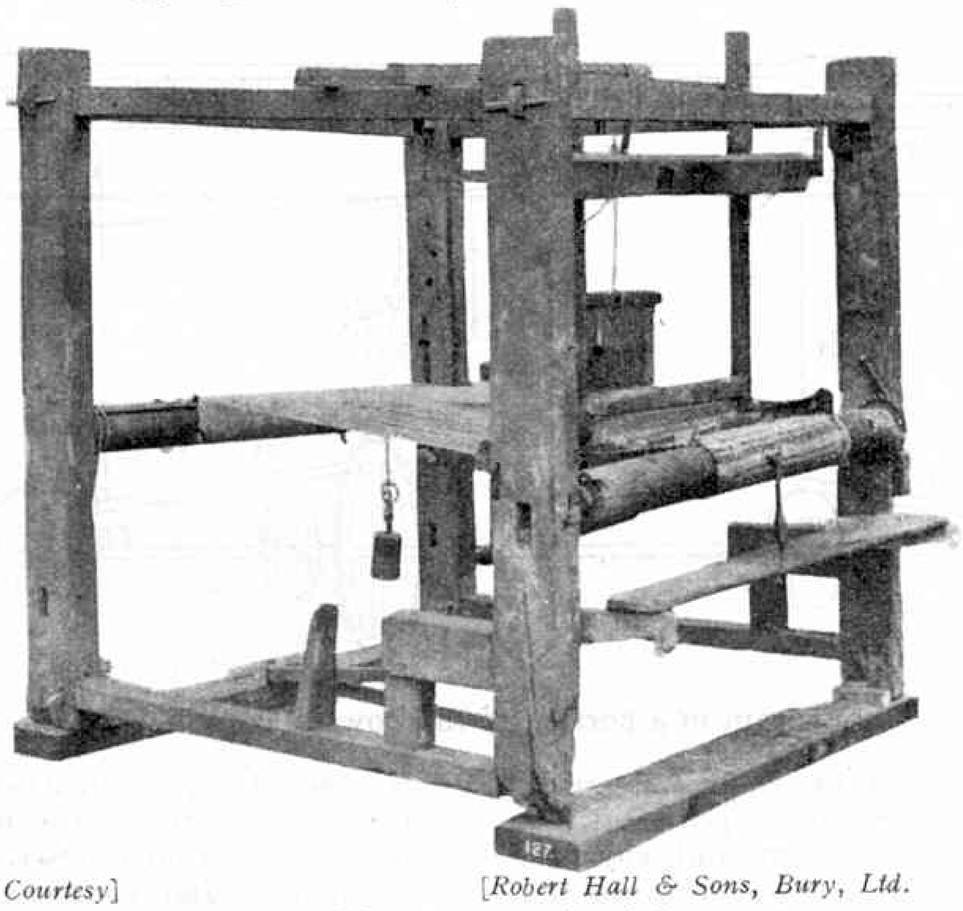
Model of mechanism invented by Cartwright for converting the reciprocating motion of the piston of a steam engine into rotary motion.

The prospects of the power loom brightened toward the close of 1791, when a Manchester check manufacturer, named Grimshaw, entered into a contract with Cartwright to instal 400 power looms in a new mill. Twenty-four of the machines were installed, and a dozen of them set to work weaving checkered cloth. The looms were operated by steam, and they produced the cloth at half the cost of the hand-woven material. The success of the machines enraged the local hand-loom weavers, and it was not long before the owners received anonymous letters threatening the destruction of the mill. One of these letters was as follows:—"Sirs—We have sworn together to destroy your factory, if we die for it, and to have your life for ruining our trade; and if you go on, you know the certainty, which comes unknown to my companions."

As a precaution the owners transferred a good deal of property, especially yarn, from the mill to some safer place. Their misgivings were justified, for in March 1792 the building was burned down. The rapidity with which the fire developed left little doubt that the mill had been fired deliberately by the angry hand weavers. The owners did not attempt to rebuild the mill, and the disaster proved a severe blow to Cartwright, for the machinery contract was not renewed.

The costly operation of the Doncaster mill steadily absorbed his funds and finally, in 1793, he was obliged to give up the factory. He assigned his patent rights in respect to the power loom to his brothers John and Charles, in compensation for a share they had taken in establishing the mill.

In the meantime Cartwright had applied his inventive genius in other directions, and on 22nd August, 1789, he had patented a machine for mechanically combing wool, an operation up to that time performed only by hand. The main features of this machine were a cylinder provided with rows of teeth and a fixed vertical comb that received the raw wool. The cylinder was made to revolve in such a manner that the teeth caught and drew out the wool held in the fixed comb.



Courtesy] [*Robert Hall & Sons, Bury, Ltd.*

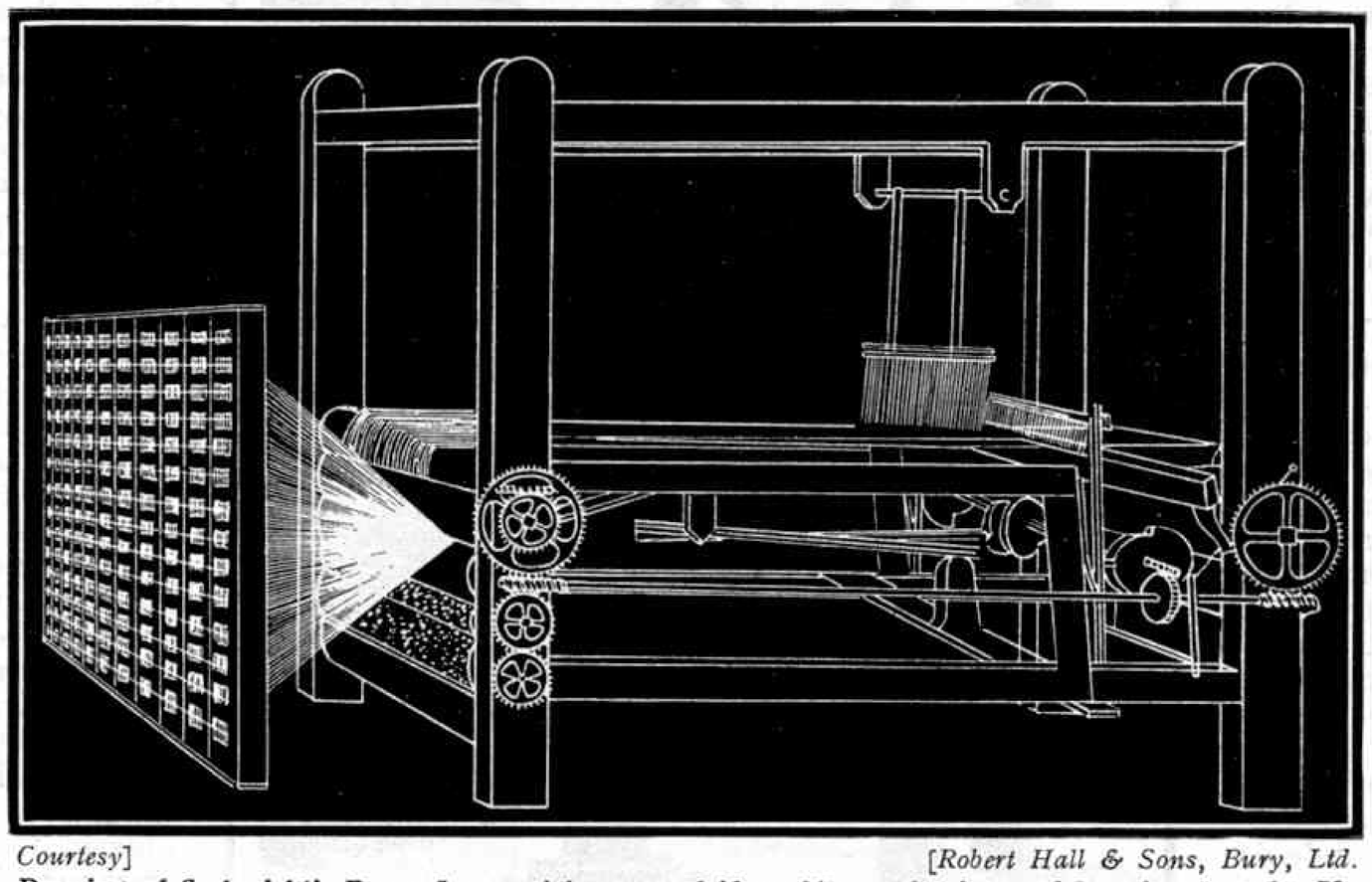
A typical 18th century hand loom.

Less than a year later Cartwright patented a different and improved type of wool-combing machine, and a further patent was granted to him in December 1790 for improvements in this machine. This patent also dealt with a device he had made for washing the wool in readiness for treatment in the combing machine. He continued to improve his invention, and a later patent in respect to it was obtained during 1792. This second type of mechanical wool-comber was entirely different from the first machine. It consisted of a horizontal circular table about 6 ft. in diameter, round the inside of which were horizontal teeth pointing toward the centre of the table. Above the table, or principal comb as it was called, was a mechanical arm termed the "crank-lasher," which was jointed in such a manner that its motions resembled those of the arm of a hand comber as he lashed the wool against a fixed comb. The action of the crank-lasher suggested to Cartwright's Doncaster workmen the movements of a pugilist, and they christened the machine "*Big Ben*," after a celebrated prize-fighter of that time.

In the cycle of operations, the washed raw wool was first placed in a cam behind the shoulder joint of the crank-lasher, and from there was fed into a delivery tube at the other end of which a pair of rollers regulated the quantity passed to the crank-lasher. This lashed the wool into the principal comb. The wool was then

extracted by a " clearing " comb that revolved under the impulse of a pair of cranks, and was placed so that once in every revolution its teeth struck through the wool held in the principal comb and cleared it out. As the principal comb slowly revolved, the freed wool came within the grasp of " delivery " rollers that withdrew it and passed it to a pair of calender rollers, which formed the wool into a lengthy and continuous sliver.

An interesting reference to the first of Cartwright's woolcombing machines to be erected in Bradford is contained in Mr. John James' Book, "*History of the Worsted Manufacture.*" The machine was purchased by a Mr. Robert Ramsbotham, and was set to work in a room behind his house in Kirkgate. Mr. James says: "The machine, which was worked by a horse running in a gin, does not seem to have answered the expectations of its purchaser, for after working for some time it was taken down and sent away; indeed it would appear to have been a source of loss and annoyance, as the old gentleman is said to have taken off his hat to it as it left his yard!"



Courtesy] [*Robert Hall & Sons, Bury, Ltd.*

Drawing of Cartwright's Power Loom, giving a good idea of its mechanism and how it operated. The warp and weft threads are shown on the right, and the vertical frame carrying the spindles of spun cotton yarn is shown to the left of the machine.

Cartwright's woolcombing machine proved of great interest to the woollen manufacturers, but its adoption was strongly opposed by the hand wool-combers. This opposition steadily increased, and between 50 and 60 petitions against the use of the machine were presented to Parliament during a single session in 1796. The efficiency of the machine made it too valuable to the woollen industry to be rejected, however, and in spite of the prejudice of the hand workers wool-combing machines gradually came into use. The majority of these machines were not made under Cartwright's patent, but were ingenious imitations of his invention; and in consequence Cartwright again found himself involved in expensive lawsuits to uphold his patent rights. During 1801 he petitioned Parliament for an extension of his patent and, in spite of opposition, his application was granted and his patent extended for a further 14 years. Other inventors improved Cartwright's machine and raised it to a high degree of efficiency, with the result that eventually it came into general use.

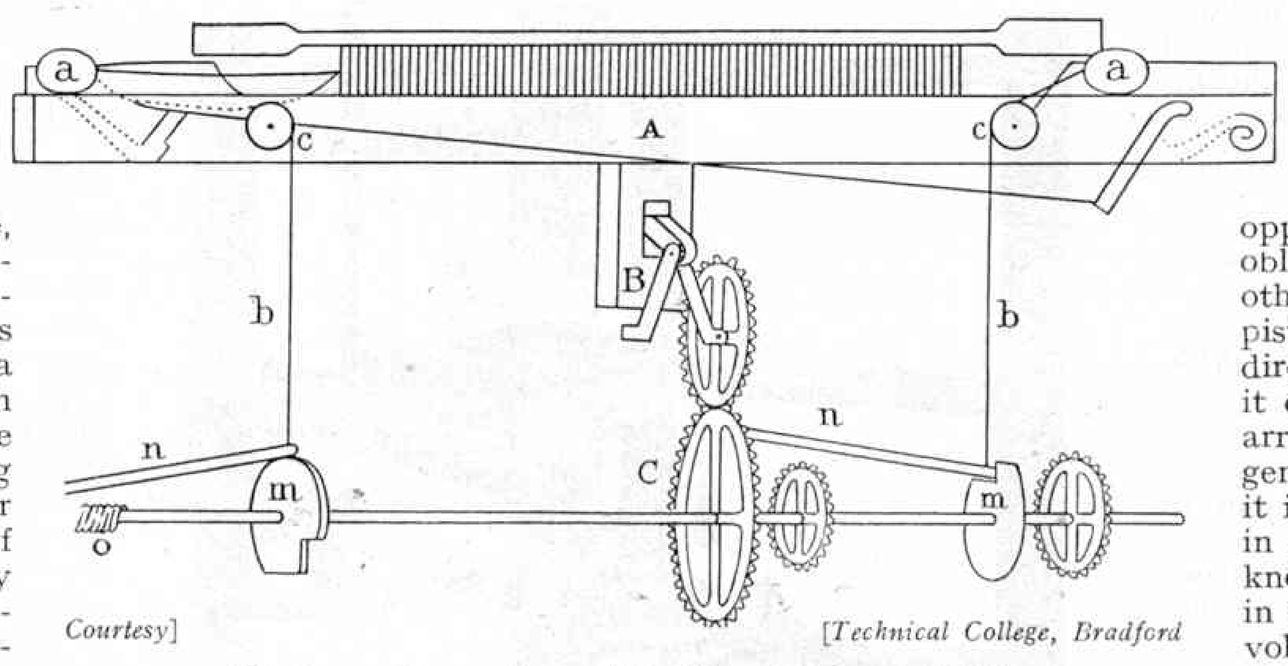
In addition to the invention of the power loom and the wool-combing machine, Cartwright found time to interest himself in the development of the steam engine. As early as 1786 he devised a number of improvements in steam engine design, and he refers to these in an interesting letter to a friend. The letter also reveals his strict sense of fairness. "I am infinitely obliged to you for your attention in procuring for me admission to the Albion Mill. You will be surprised when I tell you that I have at present an insuperable objection either to seeing Boulton's steam-engine, or the still more powerful one invented by Sadler of Oxford, which is now in town, and which he has promised to shew me. My reason is, that I am now making a model of one that I have invented myself. I wish to avoid temptation either to borrow or steal. . . From the short conversation I had with Sadler, his improvement consists principally in having a double cylinder, so that the steam condensed both above and below the piston. My improvement consists in having neither cylinder, piston, condenser, nor beam; nor, in short, any species of mechanism. When my model is finished, which will be in a day or two, you shall hear more of it. . ." The Albion Mill referred to was the famous one in London established by the engineers Boulton and Watt, and destroyed by fire in 1791.

There is no record that Cartwright put his early schemes into practice, and he did not seek a patent for a steam engine until 1797. In the engine then patented he endeavoured to remedy the imperfect vacuum, excessive friction and complicated construction of parts that he considered were the chief defects of existing steam engines.

The Cartwright steam engine included a single-acting vertical steam cylinder, the piston of which was carried down to the bucket of an air pump. This pump was situated in an immersed condenser of the surface type, that consisted of two cylindrical casings enclosed one inside the other. Cartwright sought to reduce friction to a minimum by making the piston and its packing entirely of metal. The piston was constructed of two metal plates, between which were placed a number of metal rings which, by means of a spring, were kept equally tight irrespective of the wear of the piston.

When the engine was working the piston descended under pressure of steam, and when almost at the foot of its stroke a spring on the cross-head closed the steam valve. The spindle of an exhaust valve fitted in the piston then struck the base of the cylinder, causing the valve to open and allowing the steam to enter the immersed condenser. Not only was the condenser totally immersed, but also cold water flowed through the inner casing. By this means a very thin body of steam was subjected to the largest possible cooling surface. The escape of the steam into the condenser relieved the pressure upon the piston, which then returned to the top of the cylinder under the action of the engine flywheel.

Cartwright included in the patent for the steam engine his plan for improving a rotary engine described by James Watt in 1782. On the previous page is an illustration of a model of Cartwright's mechanism for converting reciprocating motion into rotary motion. The end of the piston rod is not guided by parallel motion, but by means of a long crosshead secured to the piston rod and equipped with a pair of connecting rods that are coupled to two cranks. These cranks are geared together and revolve in opposite directions, so that their oblique thrusts neutralise each other, with the result that the piston rod has only to resist the direct effort of the piston, which it does easily. This important arrangement did not come into general use for many years, but it is now employed successfully in the type of rotary air pump known as a "pressure-blower," in which it drives the two revolving prisms. In this form of pump the engine crosshead is provided with slide guides. In the model engine illustrated the valve motion is obtained directly from that of the piston by a tappet action, which was one of the innovations that Cartwright introduced in his steam engine.



Courtesy] [*Technical College, Bradford*

Diagram of a portion of the Power Loom of 1790.

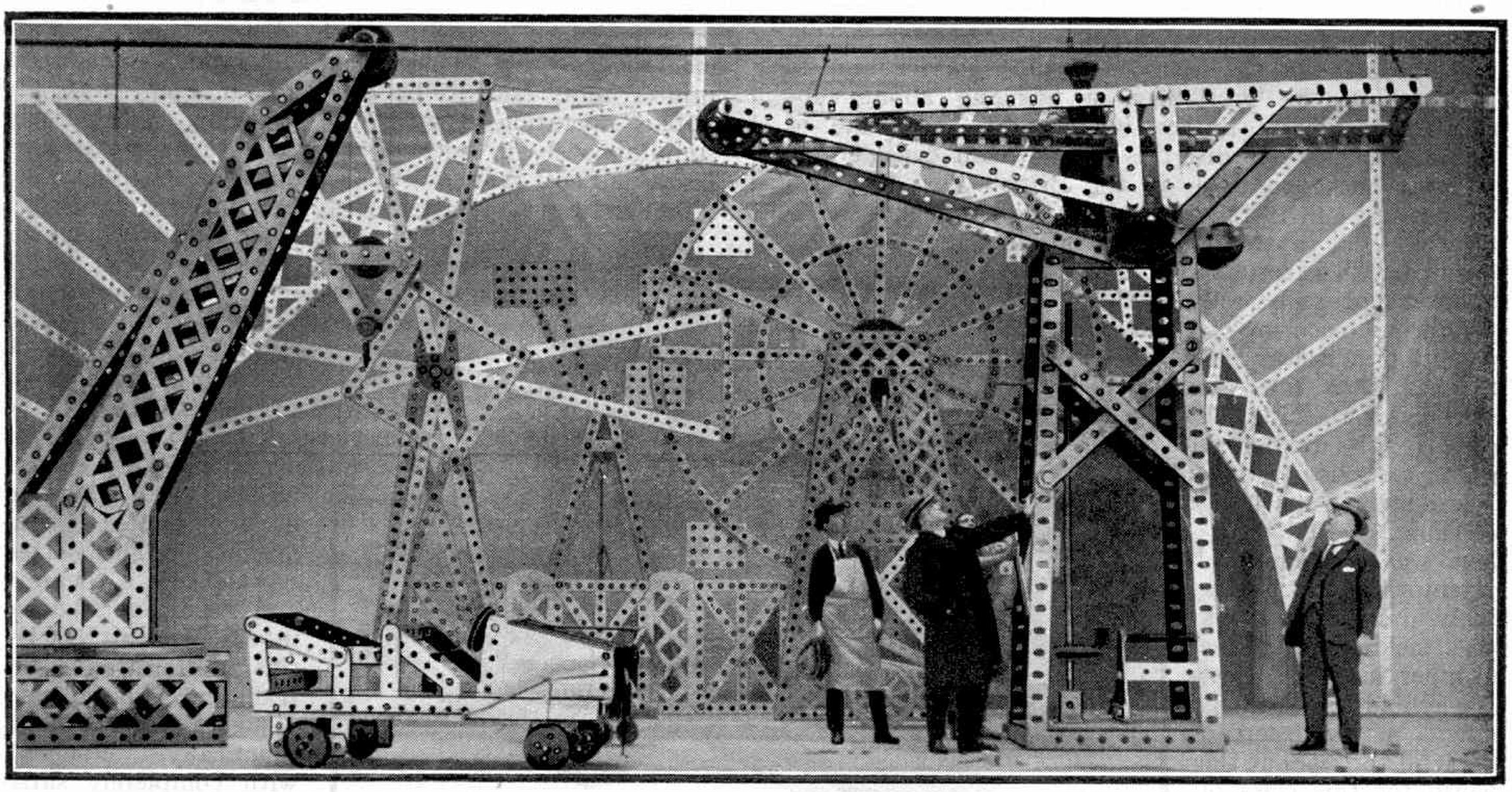
During 1796 Cartwright moved to London, where he soon gathered around him a group of enthusiastic inventors that included Robert Fulton, who later became famous as the first man to construct a steamboat in the United States.

Cartwright was ever on the lookout for fresh opportunities to apply his inventive genius, and among the minor inventions that he produced were a rope-making machine, patent bricks that were grooved in the middle so that they could be fitted together; and a foot-propelled road carriage. The axle of the driving wheels of this vehicle carried two cranks that

(*Continued on page 40*)

Meccanoland in Manchester

Giant Models Worked by Real Meccano Boys



"THE best age to start Meccano is anywhere between five and seventy." The truth of this famous slogan is emphasised more and more every year. Toys of some kind have existed from the earliest days of civilisation, but it is safe to say that no toy has ever approached Meccano in its universal appeal to the imagination of young and old alike. There are many reasons for this, but probably the great secret of the popularity of Meccano, both with those who build and those who look on, lies in its intense realism.

Many years ago Mr. Julian Wylie, most famous of pantomime producers and himself a Meccano enthusiast, was sitting in his room making plans for the approaching pantomime season, and trying to devise an entirely new type of scene. Something turned his thoughts to Meccano, and suddenly there flashed across his mind the vision of a Meccano scene, in which the central feature should be Meccano models of gigantic size, all working, and tended by a host of real Meccano boys. Rapidly the idea was developed. Giant Meccano parts, each designed exactly on the lines of the originals, were constructed, and models of enormous size were assembled on the stage. The effect surpassed all expectations, and the success of the scene was assured.

The Meccano scene appeared in its full splendour in the pantomime "*The Sleeping Beauty*" at the Empire Theatre, Liverpool, in the 1926-7 season. It aroused tremendous enthusiasm at every performance, and it was difficult to decide whether Meccano boys or "grown-ups" were the more fascinated. The success of the scene led Mr. Wylie to repeat it, on an even more gorgeous scale, in his "*Sleeping Beauty*" pantomime of 1929-30 at Drury Lane, London; and this season it forms one of the outstanding attractions of the Wylie pantomime "*Dick Whittington*" at the Palace Theatre, Manchester.

The main feature of the scene is, of course, the giant Meccano models. These include a monster aeroplane that flies, a motor car, a windmill, a huge hammer-head crane, and a variety of motor cars, trucks and other smaller models, all working. These models are exact large-scale copies of the corresponding Meccano models, except that the parts are made of wood instead of steel. Wood is used on account of its lightness, for it will readily be understood that steel parts of this enormous size would have required a powerful crane to handle them, and would have been altogether unsuited for use on the stage. The parts are all finished in aluminium paint, and in the intensely brilliant stage lighting they look exactly like highly polished steel.

Miss Fay Compton, the principal boy in "Dick Whittington," Palace Theatre, Manchester, the pantomime in which the wonderful Meccanoland scene is included.

On the stage these wonderful giant models work in exactly the same manner as those of ordinary size that may be built from standard Meccano parts of steel and brass. The work of preparation occupied two months, and in order to ensure absolute accuracy each model was first built in Meccano to provide a pattern for the enlarged version seen on the stage.

The Meccano scene is planned on gorgeous lines. In addition to the giant models the stage is occupied by Meccano boys wearing the regulation jersey and a chorus wearing unique head-gear, each member's hat being crowned by a different Meccano model in miniature. The lighting effects are a great feature and the whole of the apparently inexhaustible electrical resources of the theatre have been called upon to bathe the stage in a wonderful glow—the result of bank upon bank of lamps with a total of thousands of candle power. The immense switchboard from which the lighting of the theatre is controlled is fitted with every mechanism yet invented. The operator in charge is able to vary his lighting effects with a rapidity that is almost startling, and he may produce lights of every colour and strength, either separately or blended into the most wonderful combinations.

This scene alone is worth a long journey to see, and I can assure all Meccano boys that they will be fascinated. This pantomime is not merely an affair of costumes, songs and dances, but is, in fact, a great feat in engineering.

Teleprinters for Railway Telegraphy

Interesting Development on the L.M.S.

IN 1927 the Postmaster General appointed a committee to report on the inland telegraph service and to examine the possibility of bringing about substantial economies in the working by the State of this service. Following this appointment considerable progress has been made in the British Post Office in the testing and installation of different models of teleprinters, and in standardising, training and operating. The results are now becoming apparent generally, and the teleprinter is securing the keen attention of telegraphists in a manner that few other systems or machines have done. The British telegraph service without Morse seemed inconceivable, and yet here was a machine attempting the seemingly impossible task of attacking the Morse sounder in its greatest stronghold! There is now a widespread demand throughout the world for this class of telegraph machine. In this country installations are being completed on public and private circuits as rapidly as the necessary apparatus can be obtained. In the United States thousands of sets are being absorbed annually by American telegraph companies; while in the Dominions and in France, Germany, Holland and Denmark, considerable activity in the same direction is in evidence.

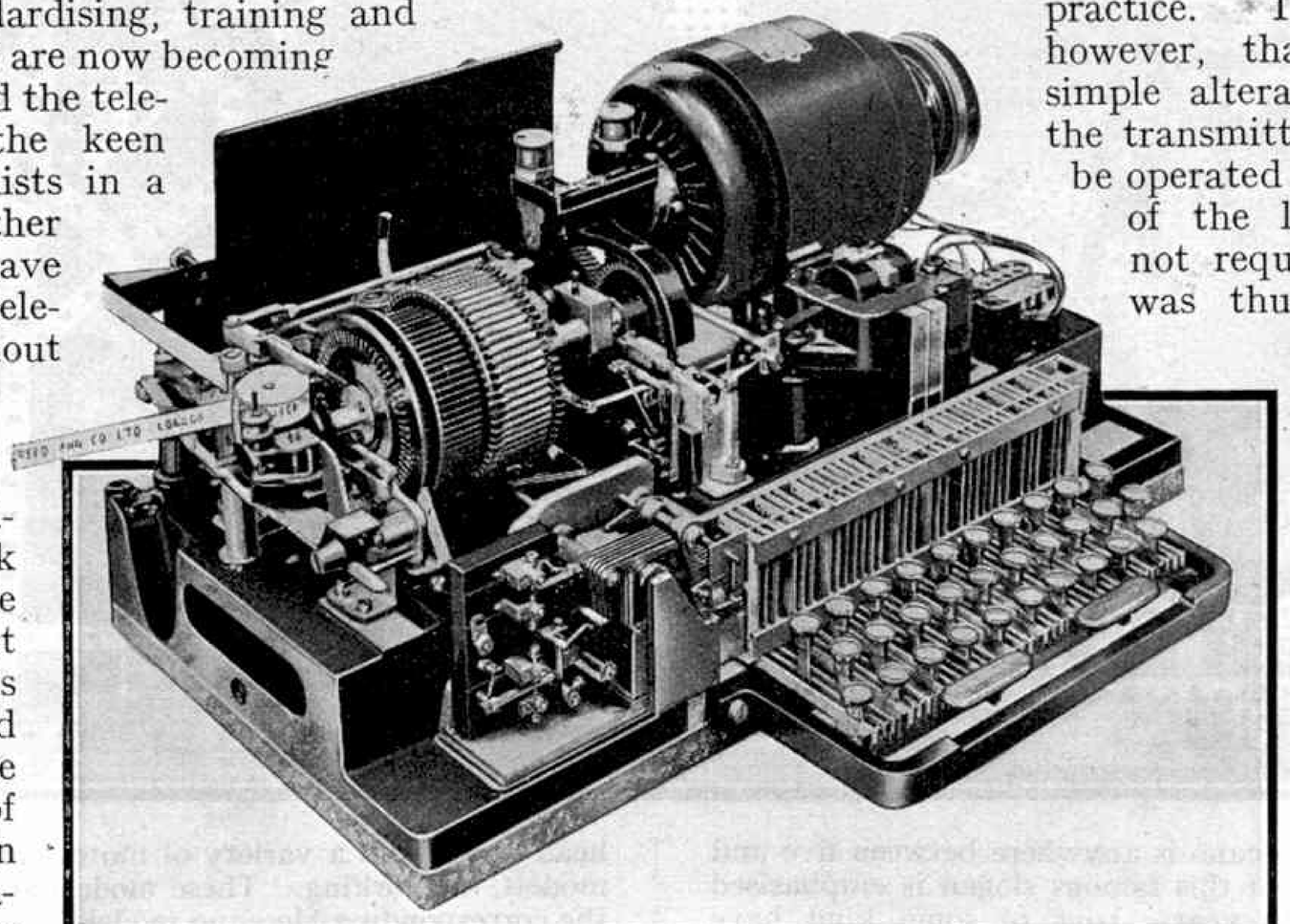


Fig. 1. Creed teleprinter with cover removed, showing transmitter and printer.

Various types of printers have been used by the British Post Office, but in 1924 Creed & Co. Ltd., of Croydon, entered the field with a British machine. Trials took place over an extended period and, as a result of continuous improvements in design, the operation of the Creed teleprinter No. 3a reached a high standard of efficiency. When it was originally introduced the teleprinter was arranged in such a manner that only one message could be signalled at a time in either direction, the characters transmitted being recorded on a local tape as well as at the distant station. Two machines, or one complete machine and a separate printer unit, had to be provided at each office for duplex operation—that is the signalling of telegrams simultaneously in both directions. Considerations of space and cost rendered this arrangement unacceptable, although it was understood to be standard American practice. It was ultimately found, however, that as the result of a simple alteration in the connections the transmitter and the printer could be operated separately at the expense of the local record, which was not required; and one machine was thus made to provide for simultaneous transmission and reception under duplex conditions. This stage represented a definite and important advance in development, as by this alteration the traffic-carrying capacity of each machine is practically doubled, with completely satisfactory results.

(1714) 4/29. LONDON MIDLAND AND SCOTTISH RAILWAY COMPANY.

TELEGRAM. No.....

STATION DERBY.					DATE			
Prefix	Time handed in	No. of words	Station from	Time received	Clerk	Station to	Time sent	By
SPF	10-50	73						

ADDRESS BESLINE DERBY - JENKINS C/O FICTITIOUS LONDON -

SEND QUICKLY 35 7/8 FEET (PINEWOOD) 7979 1/2 FEET

EACH FOLLOWING THICKNESS 3/4 5/16 21/32 ALSO 40 FEET OF 5/16

15/16 9/10 PRICE NOT TO EXCEED £12/6/ DESPATCH BY STEAMER

MARGUERITE +

Fig. 2. Specimen telegram, using most of the characters on the keyboard.

The circuit on which the machines were first installed between the General Post Office and Croydon was only about 15 miles in length. Experience on that circuit encouraged the belief in the possibility of greater things, and subsequently a trial took place between the General Post Office and Carlisle, a distance of approximately 300 miles. The results obtained were thoroughly satisfactory, and a further impetus was given to development.

The fallacy that the system was only suitable for short line working was finally exploded. At the same time improved acquaintance with the keyboard made operators confident and efficient. Outputs of 70, 80 and 90 telegrams per hour in one direction or another were obtained on the trial circuit. Since 1923 the Post Office have installed no fewer than 700 teleprinters, and but for difficulties in regard to delivery and other matters the record would have

been even better.

Last year the Chief General Superintendent after consultation with the Telegraph Engineer, decided to adopt teleprinters on circuits between the principal stations on the London Midland and Scottish Railway Company's line where the flow of telegrams—minimum 200—between 10 a.m. and 6 p.m. would justify the expenditure. These machines have been installed in the telegraph offices at Euston, St. Pancras. Birmingham, Derby, Sheffield, Leeds and Manchester. Morse sounders and keys are also provided with each circuit, to be switched in as required outside the period of 10 a.m. to 6 p.m. Additional circuits are now under consideration.

The type of instrument in use is shown in Figs. 1 and 3. This apparatus uses the five-unit code, each letter of which is formed by a combination of five signals of equal length, which may be differentiated either by reversals of polarity of the current, or by a rise from zero to positive or negative. Each combination of signals is preceded by a "start" and followed by a "stop" signal. These signals are necessary to operate the printer, which starts and stops for each letter printed. It is for this reason that the Creed teleprinter comes under the heading of what are known as "start-stop" printers.

As shown in Fig. 1 both the transmitter and the printer mechanism are mounted on the same base and are driven by the same motor. This motor drives through gearing a spindle and clutch to operate the printer, and another spindle and clutch to operate the transmitter.

Teleprinters are usually set to work at a speed of 66 words per minute, and the keyboard can be operated up to this speed. In practice it is found that a skilful operator can transmit for long periods at a speed of from 50 to 60 words per minute; and an average operator can easily maintain from 40 to 50 words per minute. The teleprinters print on a gummed tape $\frac{3}{8}$" in width, and one reel of tape is sufficient for printing about 16,000 words. After printing, the tape from the machine is passed over a water wheel to moisten the gum, and is then attached to the telegraph form.

The arrangement of the type keyboard, including an outline of the fingering adopted in touch typing, is shown in Fig. 4. Conventional typewriter practice is followed in the disposition of the letters and numerals, but some of the secondary characters are distinctive. On the centre keys in the middle bank are provided several numerators to facilitate the transmission of the fractions in most common use. The denominator is produced by printing an appropriate numeral immediately after the combined numerator and oblique stroke. By this means a considerable range of fractions can be expressed in fractional form, with a minimum amount of signalling. The symbol on the key at the extreme left of the bottom bank is used to indicate an erasure; and that on the extreme right is operated for the "end of message" signal.

Fig. 3. The Creed No. 3a teleprinter. For the illustrations to this article we are indebted to the courtesy of the L.M.S.

As there are only 32 possible combinations of the five-unit code the numerals and other special characters are operated by the same combination as that employed for the letters. The change is accomplished by a signal called the "figure shift," and the change from figures to letters by a signal called the "letter shift."

A departure from typewriter design is the provision of two space bars, the functioning of which is twofold. They provide the spacing between words or groups, and in addition they determine whether the characters to be printed shall be those on the "letter shift" or the "figure shift." A specimen telegram constructed to include practically all characters on the keyboard is shown in Fig. 2.

The teleprinter circuits have now had a thorough trial, and although there have been many difficulties—some quite unforeseen—resulting from the introduction of such intricate machines, the staff of the Signal and Telegraph Engineer are to be congratulated on the excellent results that are now being obtained.

By means of the Creed teleprinter an output of 800 messages between 10 a.m. and 6 p.m. on duplex circuits and 400 messages on simplex circuits has been obtained; and in an hour's trial 215 messages were dealt with by duplex and 90 by simplex without any difficulty. Between 400 and 500 telegrams can be disposed of daily, working simplex, as against an average of 150 per day on railway telegraph circuits of other types. On the teleprinter circuits there are no longer batches of telegrams waiting to be dealt with between 5 p.m. and 6 p.m. and at 12 noon on Saturdays. Telegrams are delivered to their destinations before the closing of offices, with the result that the company's business is now conducted more quickly and efficiently, and a considerable decrease in repeat telegrams has followed.

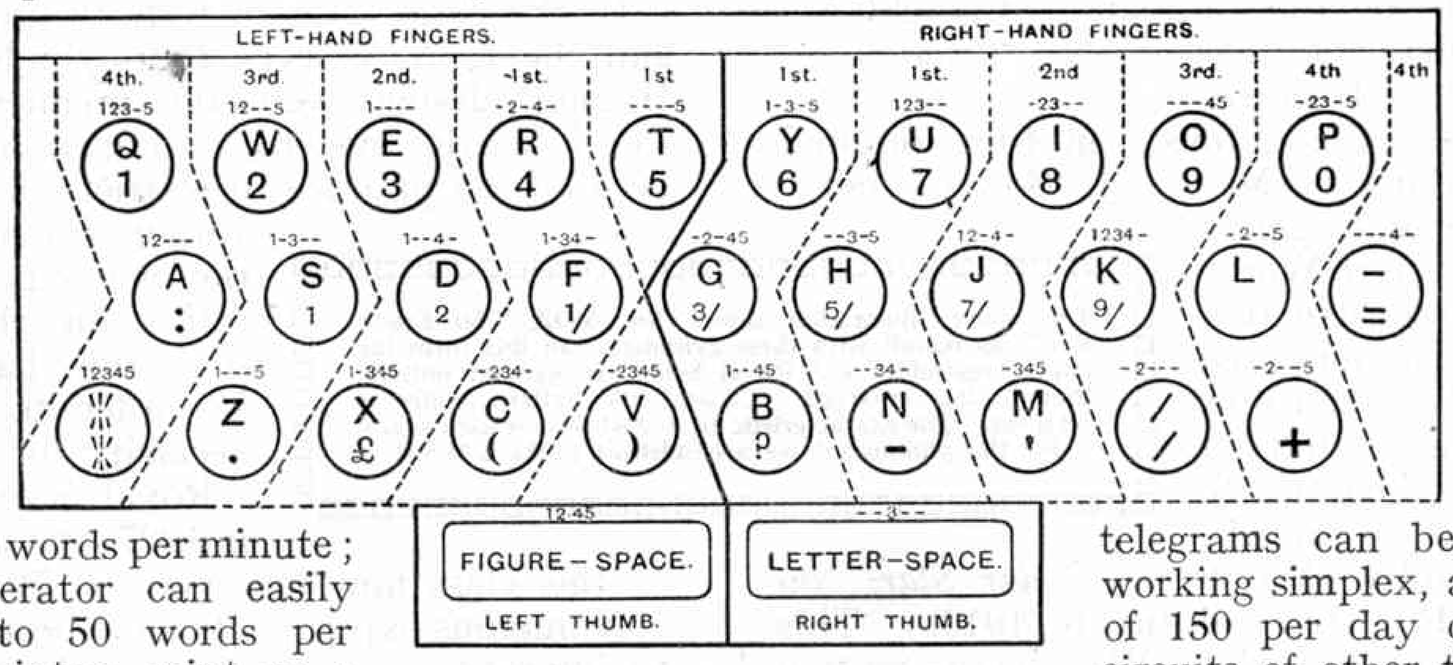
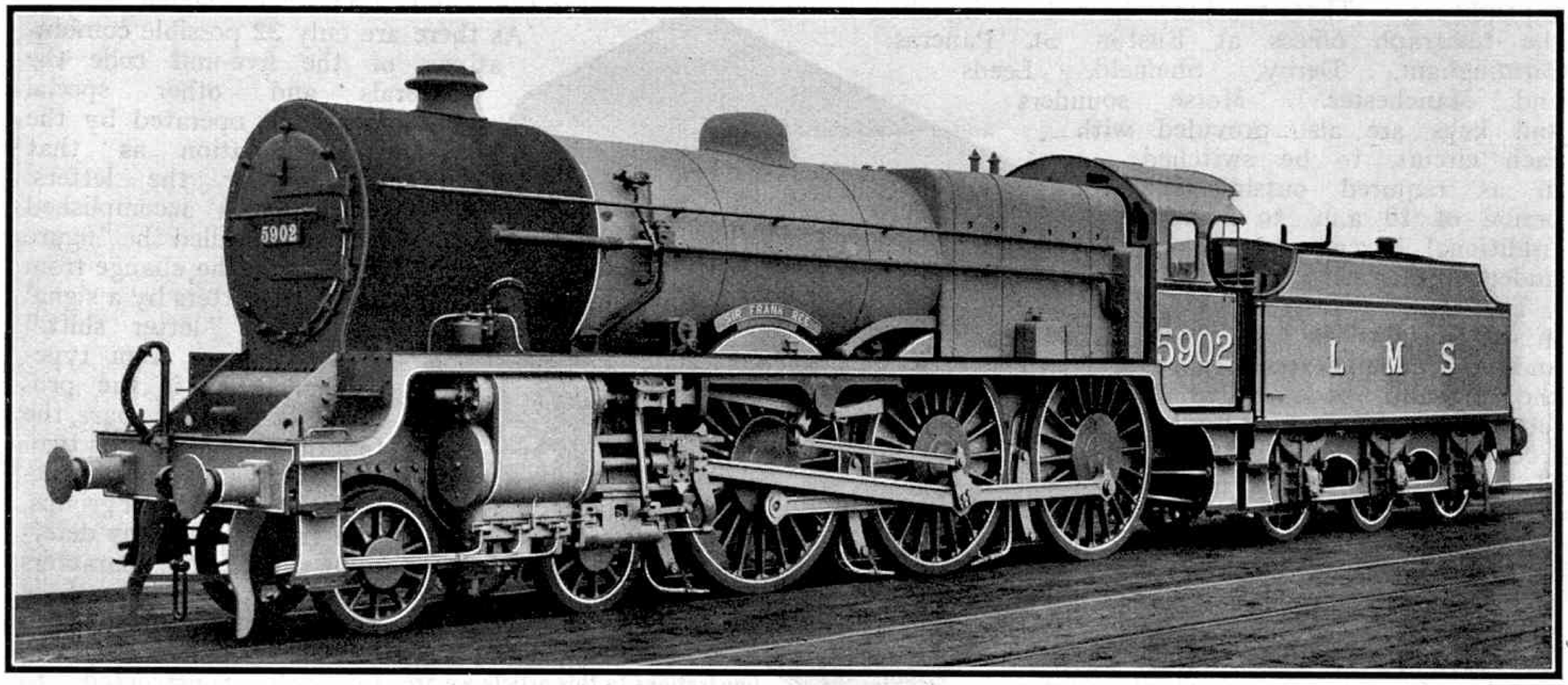


Fig. 4. The arrangement of the type keyboard in the teleprinter.

The work is less arduous than that of Morse or other telegraph circuits, and except for the timing in and out, and the clerk's signature, no writing is necessary. The L.M.S.R. are the first in the field to adopt teleprinters of this type for railway circuits.

Rebuilt "Claughton" Locomotives



The above illustration shows No. 5902, "Sir Frank Ree," as rebuilt with three cylinders. In this form the engine resembles a "Royal Scot" in general outline, though the enlarged "Claughton" pattern boiler is retained. The characteristic driving wheels are used again. For this photograph we are indebted to the L.M.S.R.

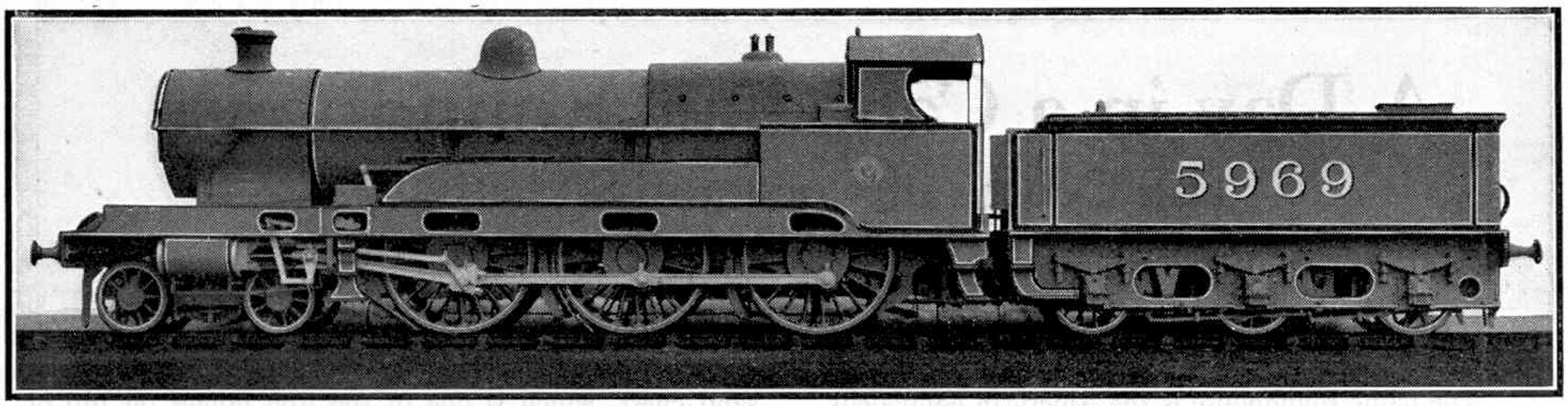
REFERENCE was made in last month's *"M.M."* to the fact that the two "Claughton" locomotives being rebuilt at Derby Works were nearing completion. These locomotives, No. 5902, *"Sir Frank Ree,"* and No. 5971, have now been turned out, and the former is illustrated on this page. In view of the interest that has been shown in these much rebuilt locomotives, we give a brief account of the history of the class. On the following page are shown No. 5969, as an example of the ordinary "Claughton" with the original boiler; and No. 5999, *"Vindictive,"* the first of the reboilered series.

The pioneer of the "Claughtons" in their original form, built to the design of Mr. C. J. Bowen Cooke, then Chief Mechanical Engineer of the L.N.W.R., left Crewe Works in January 1913. The construction of this engine had been rumoured for some time, and the use of four high-pressure cylinders and a Belpaire fire-box was held to be the result of the successful running of the G.W.R. locomotive No. 4005, *"Polar Star,"* on the heaviest L.N.W.R. express duties in 1910. This was also the first occasion on which Walschaerts motion appeared in a Crewe-built engine, previous practice having favoured for some time the almost exclusive use of Joy's valve gear. The G.W.R. locomotive had Walschaerts gear placed between the frames, and the different pairs of cylinders inside and outside drove different axles. In the "Claughton," on the other hand, all four cylinders were placed in line and drove the leading coupled axle, and the valve motion was placed outside.

Other engines were added during the same and subsequent years until the total number of the class reached 130. In accordance with L.N.W.R. practice the earlier engines bore names, but during the War period the naming of new engines was discontinued, so that many of them are nameless. Several of the later engines had names added subsequently, however, in the years prior to grouping. Possibly the best known of the class is *"Patriot,"* the original No. 1914, and now L.M.S.R. No. 5964. This engine was named and numbered *"In honour of the fallen L.N.W.R. employees 1914-1919,"* this inscription being placed on a specially large nameplate.

In the early days of railway grouping these engines, and the L. & Y. type four-cylinder 4–6–0's of Mr. G. Hughes' design, were the premier express engines of the L.M.S.R. system. For a number of reasons it became the practice to restrict the loads hauled by the various classes of engines, so that the majority of fast and heavy trains on the system were for some time hauled by two engines. In order to do away with the necessity for this, the well-known "Royal Scots" were introduced in 1927, and the number of engines of this class now in service is 70.

Numerous experiments have been made since grouping to improve the efficiency of the "Claughtons"; for although in their time they have rendered good, and on occasion remarkable service, they have often appeared deficient in boiler capacity, and as a result their coal consumption has been on the heavy side. Thus, as previously recorded in these pages, No 5908, *"Alfred Fletcher,"* was fitted in 1926 with Caprotti poppet valves and gear, and a distinct saving in fuel, as compared with a similar engine with ordinary Walschaerts motion, was the result. The first engines originally had cylinders 16 in. by 26 in., but subsequently the dimensions were changed to $15\frac{3}{4}$ in. by 26 in., and there were also instances of a diameter of $15\frac{1}{2}$ in. This makes it appear as if Crewe was undecided exactly what size of cylinders



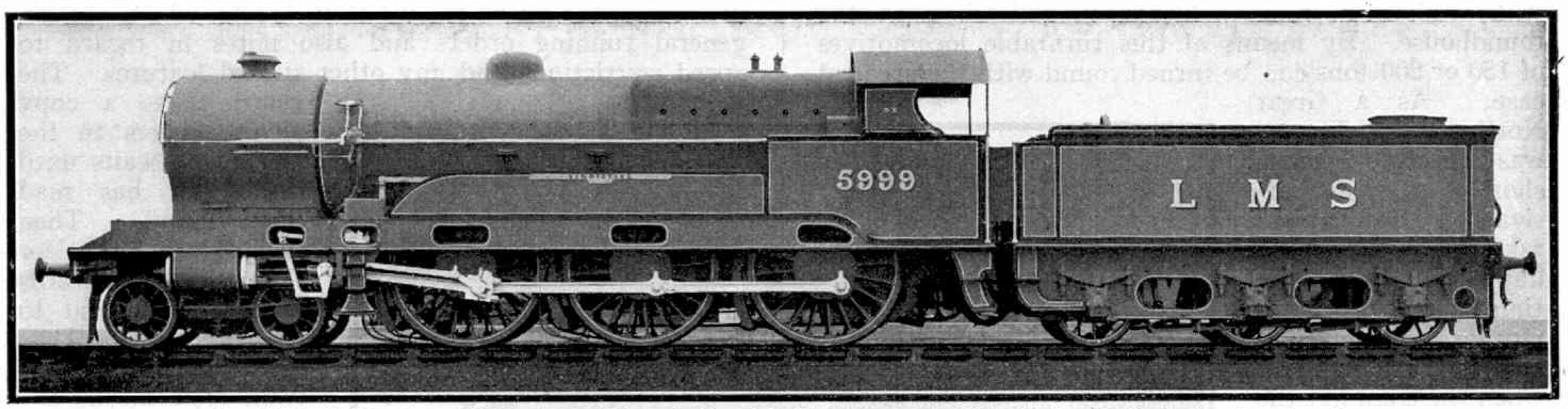
No. 5969, a "Claughton" locomotive with the original boiler.

was best suited to the steam-raising capacity of the boiler.

In 1928 No. 5999 "*Vindictive,*" was turned out from Crewe with a larger boiler than had previously been fitted, although the nominal heating surface was less; and with a working pressure of 200 lb. per sq. in. instead of the previous 175 lb. This larger boiler, together with the necessity for complying with loading gauge restrictions, compelled the cutting down in height of the boiler mountings. The result was a squat chimney, which, however, retained much of its characteristic "North Western" appearance in the shape of the cap and the square base. In all, twenty of the class were provided with these boilers, ten of them retaining the ordinary Walschaerts motion and the others being fitted with Caprotti valves and gear. These reboilered engines have rendered excellent service, particularly on the "Irish Mail" trains and the Manchester fast expresses. Until recently "Royal Scot" locomotives were not allowed to work to Holyhead and to Manchester, owing to reasons of weight, and hence the almost exclusive use of reboilered "Claughtons" on these duties. The restrictions have now been removed, however, and "Royal Scot" locomotives take their turn on these trains.

Some time ago the decision was reached to rebuild a number of the "Claughton" class as three-cylinder locomotives, with the drive from the inside and the outside cylinders applied to different axles as in the "Royal Scots." On these locomotives the inside cylinder drives the leading wheels, and the outside ones drive the intermediate wheels. As thus rebuilt the engines are similar in general outline to the "Royal Scots," although the original "Claughton" wheels and bogies are retained. A large boiler of the same pattern as that fitted to the previously reboilered engines is provided, with a total heating surface of 2,098 sq. ft. All the three cylinders, each having a bore and stroke of 18 in. by 26 in., are arranged with Walschaerts motion having a long valve travel as is the case with the "Royal Scots." The chimney and the dome are more shapely than those of the "Royal Scot" class, but the cab and the framing are similar. The original L.N.W.R. pattern tender is replaced by a standard tender carrying 3,500 gallons of water and $5\frac{1}{2}$ tons of coal. A crosshead-driven vacuum pump is provided, and a steam brake is fitted to the coupled wheels.

Since the appearance of the "Royal Scots" on the Western division several "Claughtons," including the pioneer No. 5900, "*Sir Gilbert Claughton,*" have been working on the Midland section. One of these, No. 5971, was involved in a collision near Culgaith on 6th March last, and this engine has now been reconstructed with three cylinders in a similar manner to No. 5902. Another of them has been withdrawn from service as the result of severe damage received in the accident at Doe Hill on 12th February 1929. In order to conform with the Midland loading gauge the cabs of these engines have been modified, so that the sides are not as high as formerly, with the result that the roof appears very arched and lofty.



No. 5999, "*Vindictive,*" the first of the reboilered "Claughtons." It is fitted with Walschaerts valve gear.

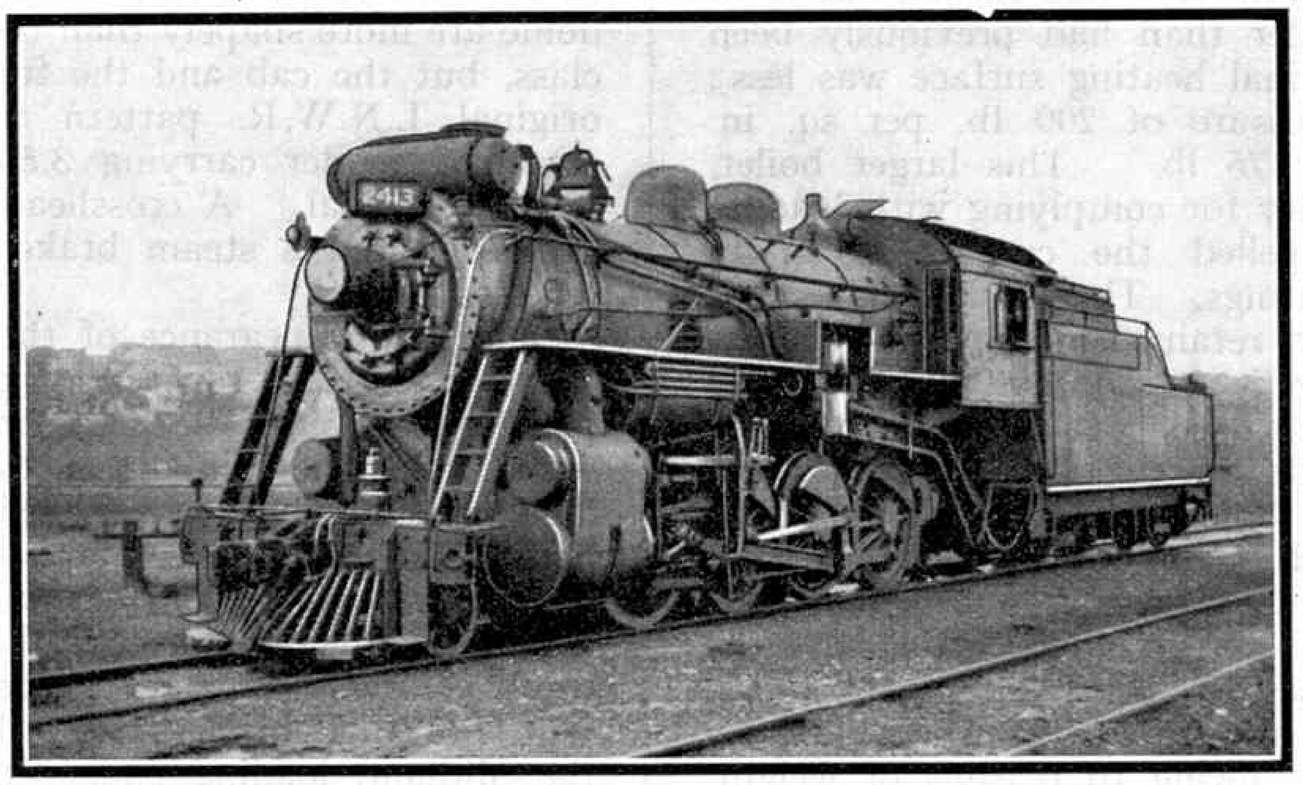
Some of the engines are provided with G.C.R. type tenders taken from the 2–8–0 locomotives acquired from the Ministry of Munitions, and originally intended for War service overseas. The original appearance of the complete engine is thus considerably modified, and this is particularly the case with No. 6001, which has in addition a chimney similar in general contour to those in use on Horwich designs, but somewhat wider. As if to carry the transformation a stage further certain of the class, while retaining their original boilers, have had their boiler mountings cut down to suit the Northern loading gauge so as to enable them to run on the Caledonian and G.S.W.R. sections. This gives the engines so treated a rather remarkable appearance.

A Day in a Canadian Roundhouse

The Centre of Locomotive Activity

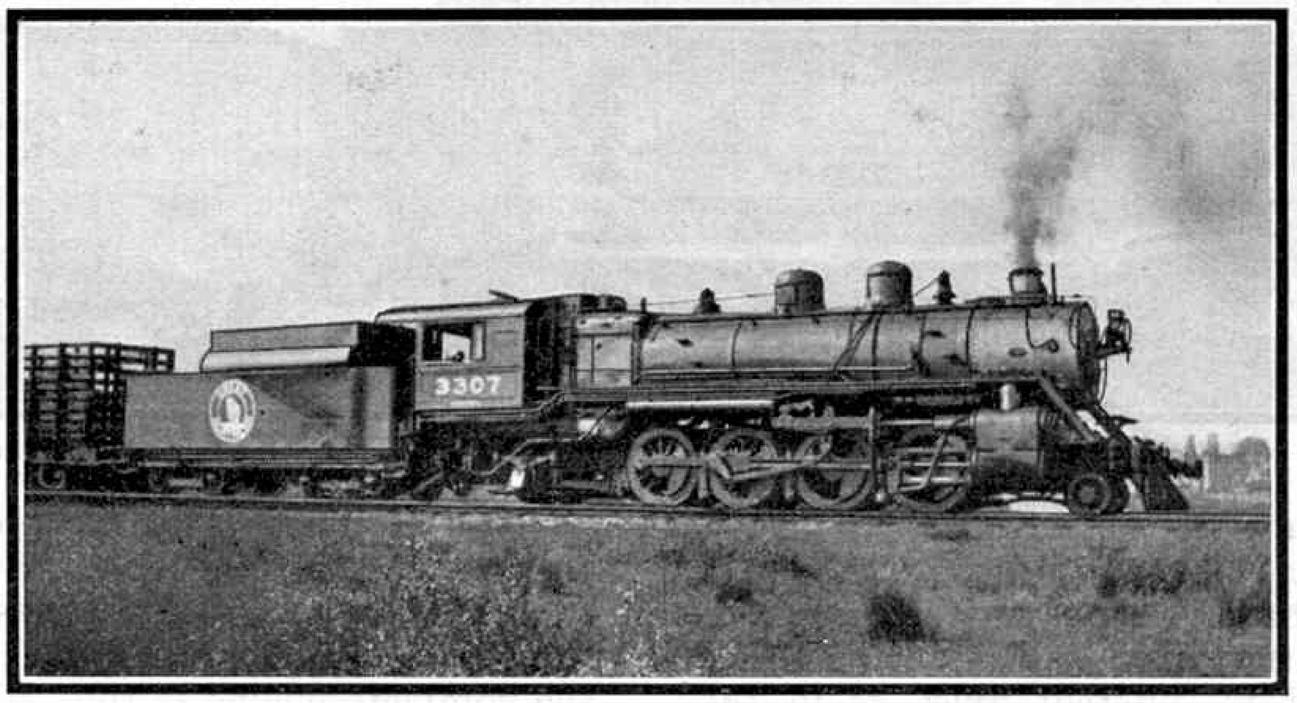
By Eric Grubb

A SHORT time ago I had the privilege of visiting the roundhouse at Vancouver, British Columbia. The name roundhouse is the American equivalent of engine shed, and it gets its name from the fact that it is a squat, semicircular-shaped building. It is always grimy and wreathed in a pall of smoke and steam, but it is the centre of locomotive activity. This particular roundhouse is of special interest because it is shared jointly by the Canadian National Railways and the Great Northern Railway, U.S.A., which sends a line up to Canada from Seattle, Washington. A further point of interest is that the Canadian National locomotives burn coal, while those of the Great Northern are oil-burners.



A Canadian National 2-8-0 passenger locomotive at Vancouver, B.C.

The first thing I noticed on approaching the roundhouse was the large turntable situated like the hub of a wheel, with many short lengths of track radiating from it like spokes, leading to the roundhouse. By means of this turntable locomotives of 150 or 200 tons can be turned round with the greatest ease. As a Great Northern "Flyer" was about to leave shortly after my arrival, I decided to take note of what happened from the time when the locomotive left the roundhouse to the moment when the train left the station. When the locomotive had been given the official "O.K." it was backed out of the roundhouse by the hostlers—or shedmen as I believe they are called in England—and on to the turntable by means of which it was transferred out on to the yard tracks again. Then it was shunted down the track to the oil tower where the oil compartment of the tender was filled with fuel oil. Next the locomotive was backed farther down the track to the water tower, where the water compartment was filled with several hundred gallons of water. Finally there came the operation of filling with dry sand the sand chest, which is one of the iron domes on top of the boiler. This sand plays an important part, being used to give the locomotive assistance on steep grades or on wet or icy tracks, or when starting with a heavy load. The sand falls to the track by means of copper pipes that lead down over the sides of the boiler and to a point just ahead of the driving wheels, a few inches from the track. The locomotive was now ready to be turned over to the engine crew.

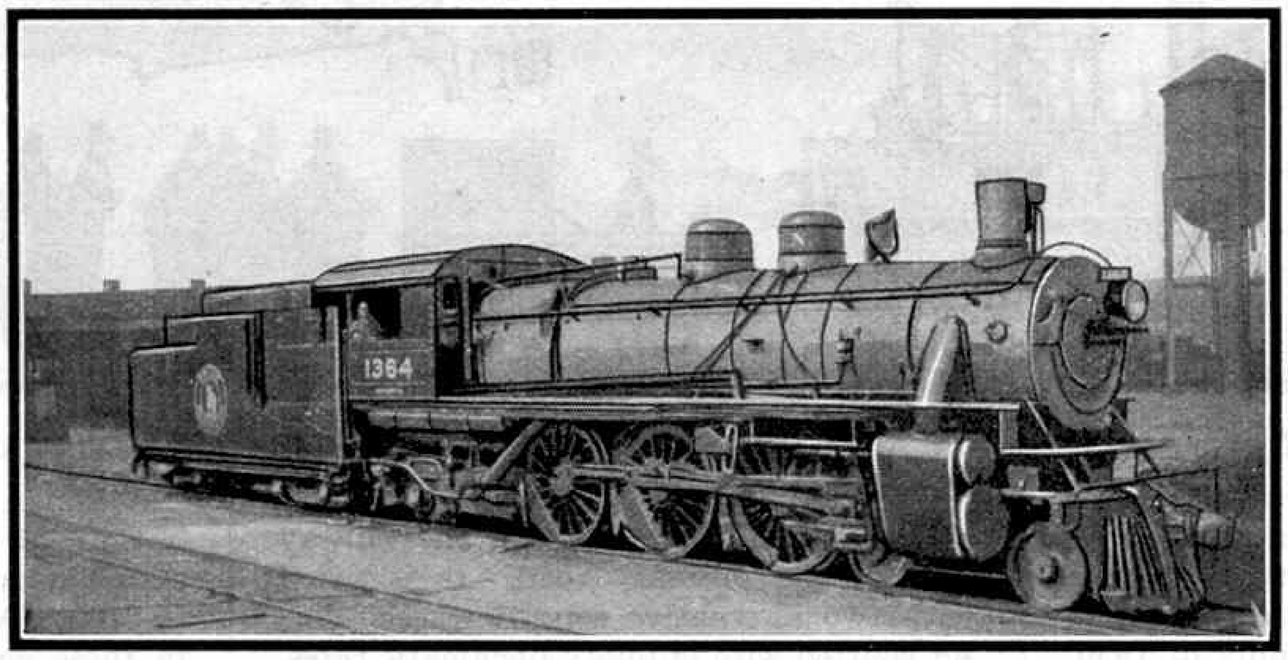


A Great Northern (U.S.A.) "Mikado" type freight locomotive used for heavy traffic between Vancouver, B.C. and Seattle, Wash.

The driver of a regular train is due at the roundhouse at least 45 minutes before he is scheduled to pull out. He inspects his engine, tests his brakes, gives a final oiling, and when he is satisfied that everything is in perfect shape he couples up with his train. Before leaving the station the driver and the guard receive train orders, which contain general running orders and also notes in regard to speed restrictions and any other special features. The guard takes a copy of the orders to the driver and waits until the latter has read them aloud. Then the driver signs for them and afterwards reads them aloud to his fireman. Thus each member of the train crew knows the orders and is jointly responsible for carrying them out.

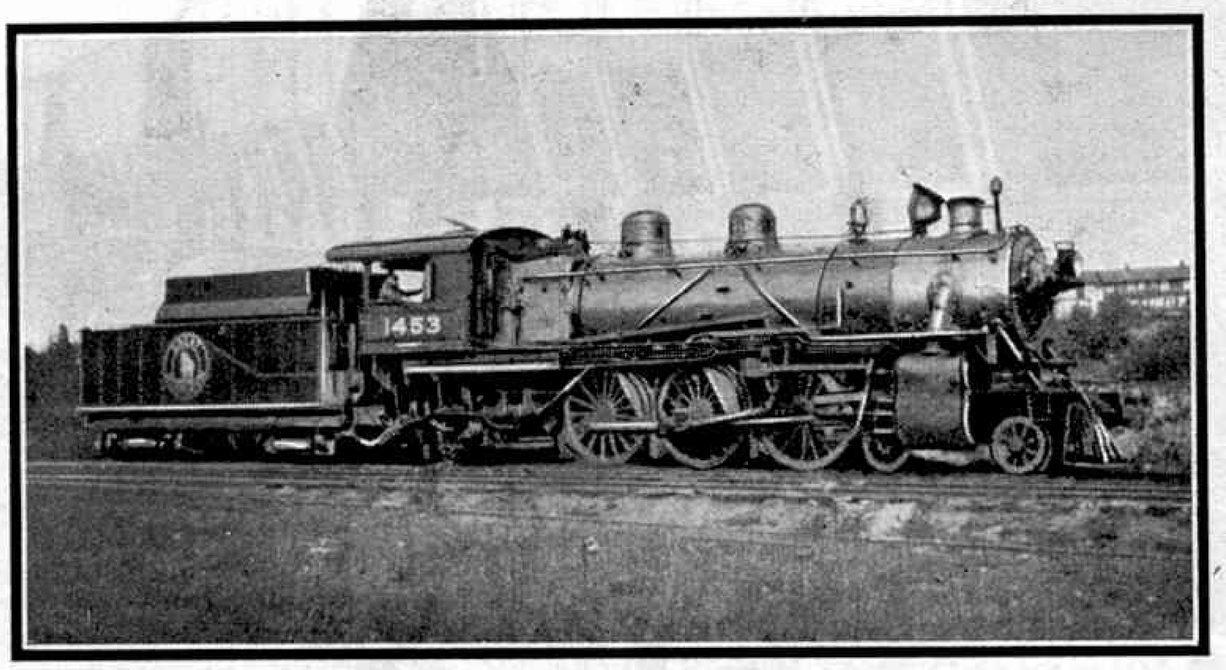
Now let us suppose that a locomotive has completed its run and is returning to the roundhouse. When it arrives the shedmen take charge of it. The driver does a bit of tinkering here and there and makes a note on his report card of any defect he has found, and then books out at the time office and hands in this card. If the locomotive is of the oil-burning type there are no ashes to be removed from the fire-box, but the engine is given a

very careful washing with a hose to get rid of all the grime and dust that have accumulated during the run. When the hosing is completed wipers rub down the washed parts carefully, and then the locomotive is shunted over on to the turntable and turned round to the proper track leading to its stall. Then it slowly puffs into the roundhouse for its well-earned rest. If any small adjustments are required, however, mechanics will work until these are carried out.



Great Northern "Pacific" passenger locomotive.

After gathering all this information I decided to go inside the roundhouse. I was taken first of all to a small office where the train crews book in and out. On the wall there is a large clock, by means of which the drivers and guards check their watches before leaving on a run. These watches are also checked by an inspector of the company at certain regular intervals. Next I was shown the register of drivers. Each driver records his mileage as well as the time he books in and out, because drivers are paid on the basis of eight hours per day, 100 miles being taken as equal to eight hours. If, however, a driver should take more than this time to cover 100 miles, owing to a breakdown or delay from any other cause, he is paid overtime. At the end of the month his wages are calculated by dividing his total mileage by 100, and for each 100 miles he is paid the usual rate, with due allowance for actual overtime.



Another Great Northern "Pacific" locomotive of the type used for fast passenger traffic.

I was taken also into the stores department, where all spare parts, oil, grease, etc., are kept. The oil is stored in bulk in large elevated tanks and is fed by gravity direct to the drivers' oil-cans by means of a pipe running from the tank to the issuing counter.

From here we went into the roundhouse proper, and the effect was similar to that of passing from a quiet park into a busy street. Lined up in front of us were many gigantic locomotives lazily puffing smoke up the smoke chutes. These chutes are let into the roof above the chimneys of the locomotives, and they collect and disperse the smoke and steam that otherwise would hang about the shed and contaminate the air. Inside the roundhouse it was dark and gloomy, but at one end a shaft of light streamed through a window and made a gleaming column through the rising smoke and steam. Men were clambering over the locomotives, testing connections, tightening nuts, oiling moving parts, and carrying out a score of other operations.

The locomotive that is booked for the run is "lit up" a few hours before it is due to leave unless—as is usually the case—a small fire has been kept in the fire-box all the time it was in the roundhouse. In the meantime mechanics have been busy inspecting everything and carrying out any repairs and adjustments that may be necessary, and the shedmen have been polishing and oiling. When all this work is completed the roundhouse foreman inspects the locomotive, and if he is satisfied that everything is in perfect order he gives the "O.K.," without which no locomotive can leave the roundhouse. After about every sixth or seventh trip the locomotives have their boilers washed out to clear them of sediment that has been deposited from the water. This sediment adheres to the tubes and prevents the full amount of heat developed in the fire-box from reaching the water, with the result of an appreciable loss in efficiency.

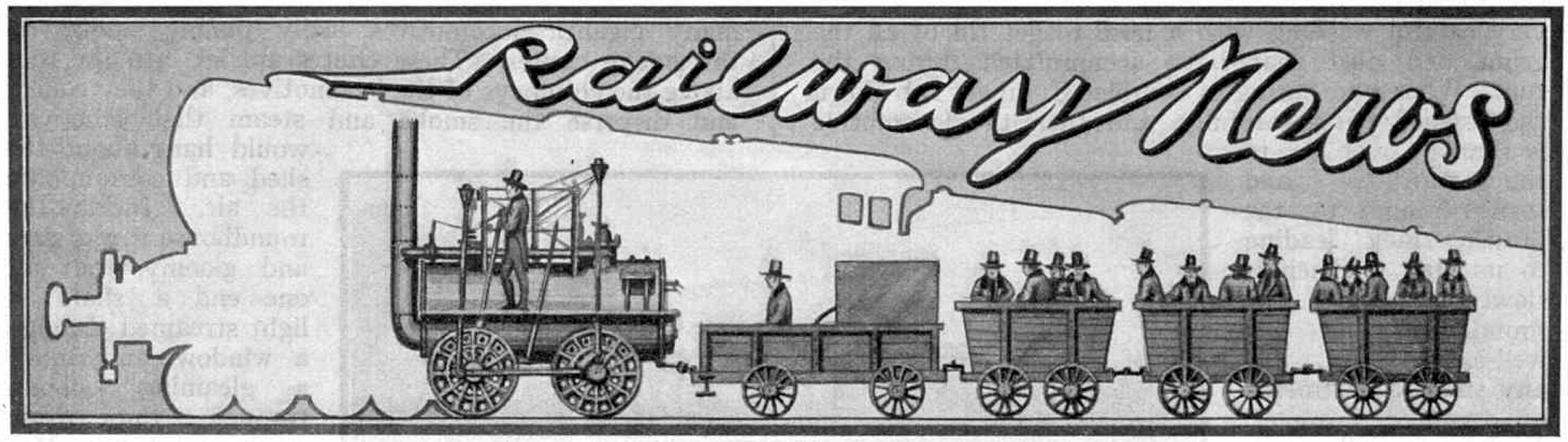
Most big roundhouses are in charge of a roundhouse foreman, who is responsible for all that goes on. In smaller railway divisions, however, where the types of locomotives are smaller and not so varied, the roundhouse comes under the supervision of the yardmaster.

Montreal Harbour Bridge—(*Continued from page 4*)

378 ft. 6 in. in length and weighing 1,515 tons in its erected condition, is in its completed state a virtually independent structure suspended at each end from the corresponding cantilever arm. During erection, however, each half of the suspended span was projected outward as an extension of the cantilever arm, resulting in heavy stresses in members at the ends of the latter, which ordinarily are almost or entirely free from stress. In making the closure at the centre it was necessary to be able to connect the members irrespective of the expansion or contraction effect of variable temperature. It was also necessary to follow the making of the centre connections immediately by a process of adjustment, whereby the stresses in the members just referred to were released, and the suspended span was allowed to assume its normal condition of a simple span swinging freely under its own weight between the ends of the cantilever arms.

In order to provide for the adjustments involved in these closure operations, eight adjustable wedge mechanisms were placed in the top and the bottom chords adjacent to each end of the suspended span. These mechanisms were designed to carry and be released under a load of 800 tons per wedge. The final closure operations were commenced at five o'clock on the morning of 10th July, 1929, under favourable weather conditions, and were completed successfully in less than five hours.

The roadway, sidewalks, and tramway tracks were completed later, and the bridge—the only exclusively vehicular traffic highway across the St. Lawrence between Niagara and the sea—was formally opened on 24th May, 1930, by the Premier of Canada, the Rt. Hon. W. L. Mackenzie King.



L.M.S. Locomotive News

Further 2–6–0 mixed traffic engines have been built at Crewe and are numbered 13207–24. These complete the order for 75 engines of this class which was put in hand at Crewe at the beginning of 1930. Twenty engines of the same class have also been built at Horwich and carry the numbers 13130 to 13149.

Four of the new "Royal Scots"—Nos. 6157 to 6160—are stationed at Holyhead for the purpose of working the Irish mail trains.

Three more of the old L.N.W.R. 2–4–0 "Jumbos" have been withdrawn for scrapping:—No. 5048 "*Henry Pease;*" No. 5064 "*Chandos;*" and No. 5087 "*Narcissus.*" Another "Claughton," No. 5933, which had been adapted to the Northern gauge, has been sent to the Midland Division. Engine No. 5141, "*Camperdown,*" of the 4–4–0 "Renown" class, has been withdrawn from service. Other recent withdrawals include No. 5155 "*Irresistible,*" of the "Renown" class and two "Cauliflowers" (0–6–0 goods with 18 in. cylinders), Nos. 8434 and 8474.

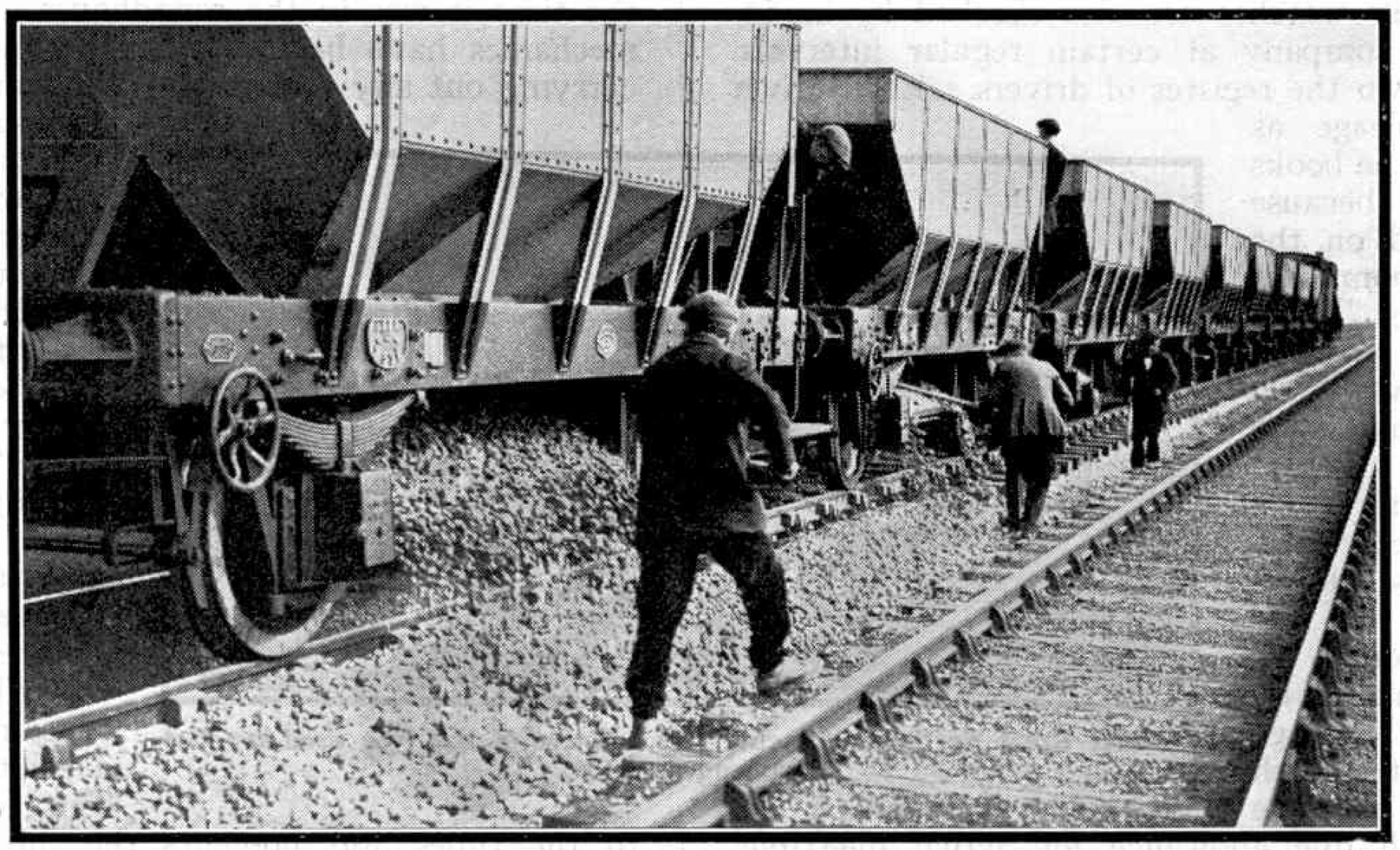
New 2–6–2 Tanks recently turned out from Derby are Nos. 15515–15519. These are in addition to the 15 constructed during last year, and when the order is completed there will be 50 locomotives of this class. The last of the 30 Beyer-Garratt articulated locomotives ordered from Beyer Peacock and Co. Ltd., has been delivered and is numbered 4996.

New Sleeping Cars on L.M.S.

Six composite sleeping cars, each weighing 42 tons and providing accommodation for 22 passengers—6 first-class and 16 third-class—have been turned out from Wolverton works recently. They have just twice as many berths as were given in cars of the former L.N.W.R. design, although they weigh three tons less. The eleven berths in the L.N.W.R. type were all single ones, however, and their accommodation was first-class only.

Rail and Road Coach

The L.M.S. are experimenting with a coach that can run both on the railway and on the ordinary road. It is fitted with two alternative sets of wheels. One set is fitted with ordinary pneumatic tyres, while the other has the flanged, steel tyres commonly used on the railway. It will be possible for this coach to pick up passengers at their doorsteps, run them to the nearest station and then continue the journey by rail. It is thought that a road-rail coach could offer attractive facilities to tourists and also prove of valuable service in the conveyance of goods.



Ballast for line repair being tipped from special wagons with hopper bottoms. These wagons discharge the material exactly where it is required on the track, ready for the permanent way men to shovel it between the sleepers.

New Special Stock

A new type of milk van has been constructed at the G.W.R. works at Swindon. The sides of the van are insulated with slab cork, 2 in. thick, placed between the inside and outside casing boards, and four ice tanks are provided to maintain a low inside temperature. The van, which is 50 ft. in length, is carried on two four-wheel bogies.

The L.N.E.R. are placing in service eighty special wagons of 50 tons capacity for the carriage of sulphate of ammonia. This chemical is usually packed in 2 cwt. bags, and each wagon will carry 480 bags. With the exception of the doors, the wagons are built entirely of steel and are mounted on two four-wheel bogies of the diamond framed pattern.

"*King George V's*" First Overhaul

A batch of twenty 2–6–2 tank engines of the "51" class has just been completed at Swindon. They are numbered 5161 to 5180. An improvement has been made in these engines as compared with those of the class built previously, in that an additional "tank levelling pipe" has been fitted. This enables the tanks to be filled more rapidly and valuable time saved when water has to be taken during stops at stations. The extra levelling pipe is fixed between the right and left hand tanks at the leading end and passes under the barrel of the boiler. The usual levelling pipe is fitted at the trailing end.

The first five of a new batch of 4–6–0 passenger engines of the "Hall" class have been completed and the remainder will follow in the early months of the year.

The famous engine No. 6000, "*King George V,*" has been to Swindon for general repairs. For the first time since its return from America, the boiler has been taken off the frames and all parts of the engine have been subjected to a thorough overhaul. It is now back in service again.

Tank engines of the 0–6–0 type are being received from contract firms at the rate of about five per week. They are equipped with automatic signalling gear at Swindon before being sent into traffic.

Among the engines recently scrapped at Swindon have been several of each of the following classes: 2–6–0 tender, "2601" Class; 2–8–0 tender, "R.O.D." Class; and 2–6–2 tank, "3901" Class.

New Metropolitan Rolling Stock

An order for additional rolling stock for the Metropolitan Railway has been placed with the Birmingham Carriage and Wagon Company Ltd., of Smethwick. This order comprises 18 motor coaches and 14 driving coaches in addition to 19 third class and 14 first class coaches. They will be of the side-door compartment type in order to facilitate rapid loading and unloading.

"No. 10000's" Trials Satisfactory

The following engines of the 4–6–0 "Sandringham" class have been completed at the Darlington works and are in traffic:—No. 2816, "*Falloden*"; No. 2817, "*Ford Castle*"; No. 2818, "*Wynyard Park*"; and No. 2819, "*Welbeck Abbey*."

Further passenger tank engines—Nos. 2901 and 2902—of the new 2–6–2 type have been built at Doncaster and put to work in the Scottish area.

The 4–6–2 "Pacific" locomotives now work occasionally on the route from King's Cross to Hitchin, Cambridge and Newmarket.

The high-pressure compound locomotive "No. 10000" has been in the shops at Darlington where important alterations have been made in the cylinders. This unique engine has come through its long series of tests very satisfactorily. In addition to numerous special trips, it has done a considerable amount of running on ordinary express trains. It is understood that the engine has proved very economical in fuel and that the estimated saving of 20 per cent. has been improved upon.

Twin Steam Rail Coach on L.N.E.R.

The L.N.E.R. have put into service in the N.E. area a Sentinel-Cammell steam rail coach of a new type. It is built on the articulated principle and the twin bodies are carried on three bogies. Accommodation is provided for 122 persons. The coach is painted green and white, and is named "*Phenomena*" after one of the old stage coaches.

The new coach has been submitted to several exacting tests which it has borne with complete success. It has made the run of 42 miles from Scarborough to York, non-stop, in 47 mins., in spite of two severe signal checks. It has also worked up to London and made special trips from King's Cross to Cambridge and back. The trips were run in less than scheduled time and a speed of over 60 miles an hour was easily attained.

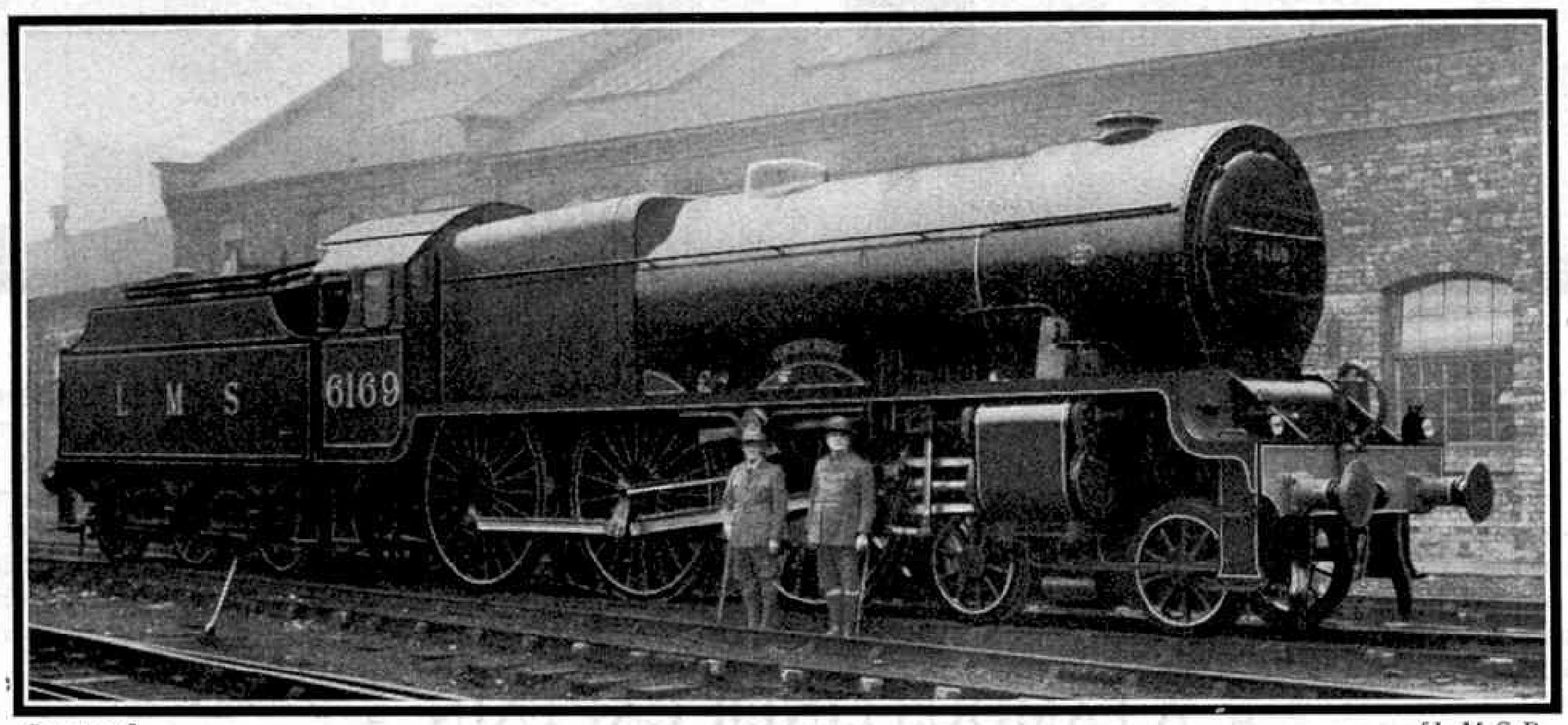
The L.N.E.R. now possess 77 steam rail coaches of different patterns. All of these are named after well-known stage coaches of 100 years ago, and thus provide a link between the old and new forms of transport. The appearance of these cars is particularly attractive, for they are finished in light green with white upper panels.

New Electric Rolling Stock for the "Southern"

The Southern Railway have placed orders amounting to nearly £500,000 for electric equipment required for the trains to be employed in connection with the extensions of their electrified system to Reigate, Brighton and Worthing, and also to provide for the increasing traffic in the London suburban areas. The orders given are for the electrical equipment only, as the actual coaches will be built in the Southern Railway's own workshops.

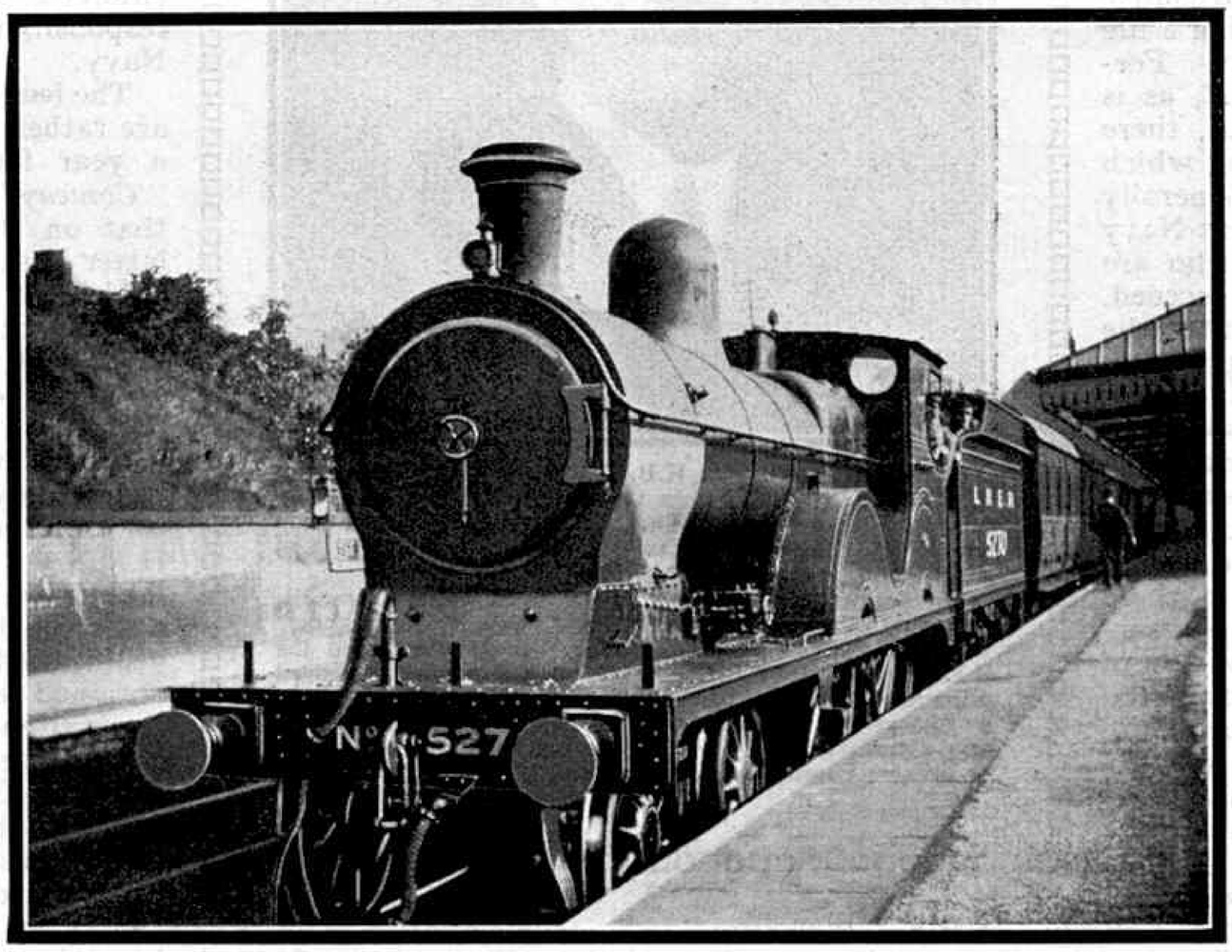
Popular Third Class Sleepers

The L.M.S.R. are building 10 new third-class sleeping coaches for the spring and summer services this year. Since third-class sleepers were introduced they have proved extremely popular and have been extended to many additional trains. It is interesting to note that on both the L.M.S. and L.N.E. Railways third-class sleepers were provided on the Christmas and New Year express excursion trains between London and Scotland.



Courtesy] [*L.M.S.R.*

L.M.S.R. 4-6-0 No. 6169 "The Boy Scout," the last of the "Royal Scot" class locomotives built at Derby works. Sir Henry Fowler, K.B.E., the designer of the "Royal Scots," is standing by the leading driving wheel, with the Scout Commissioner for Derbyshire on his right.



An L.N.E.R. 4-4-0 locomotive No. 5270 at the head of a local train at St. Micnael's Station, Liverpool, on the Cheshire Lines Committee Railway. This locomotive formerly belonged to the Great Central Railway. It is one of a class designed by Sir William Pollitt, and subsequently rebuilt and fitted with a superheater.

Push and Pull Trains on S.R.

The Southern Railway has for some time been greatly extending the use of what are known as "push and pull trains." These trains are operated by small tank engines and are equipped with apparatus by which they can be driven from either end without the necessity of transferring the engine from one end of the train to the other, as is done in ordinary steam train service when working the return trip after the outward journey. When only one or two coaches are required, the engine remains at one end of the train but when more coaches are needed, it is usually placed in the middle with coaches before and behind it. The fireman, of course, always remains on the engine footplate but when the engine is pushing, the driver takes his place in the special compartment in the front end of the leading coach and drives from there.

These "push and pull" trains are to be found at work in many parts of the Southern system and their use is to be still further extended.

Among the engines that have been adapted for this "motor" working are some of the former L.B. & S.C.R. tanks, and also a considerable number of the Drummond 0–4–4 tank-engines of the old L. & S.W.R. Some of the latest to be adapted include the following:—Nos. E 28, 29, 45, 46, 49, 51, 55, 56, 108, 109, 111, 125, and 128.

Wireless on L.N.E.R. Express

It is a noteworthy fact that recently an English express train has been fitted for the reception of wireless programmes available to first and third class passengers when the train is travelling.

The train so fitted is the dining car express, which leaves King's Cross at 10.10 a.m. for Leeds and returns the same afternoon from Leeds at 5.30 p.m. Both the dining car saloons and the adjacent passenger compartments have been specially wired and fitted with sockets into which head-phones can be plugged, in order that passengers may listen-in to the B.B.C. National Programme broadcast from Daventry while reclining in their seats.

The restaurant car attendants supply head-phones to connect with the special fittings in the compartments on payment of one shilling per journey.

XV.—A MERCANTILE MARINE OFFICER

EVERY boy at some time or other dreams of a life at sea, and in imagination sees himself as the master of a great ocean liner.

Stories of adventure afloat have thrown a glamour over everything connected with the sailor's life, and the romance of the sea forms an irresistible attraction. The unfortunate part of this is that the opposite side of the picture is ignored. The sailor is no longer sent to sea in unhealthy vessels and given bad food and poor pay, but there are still demanded of him hard work, often under trying conditions, and unremitting attention to duty. He must be prepared for a variety of hardships, and to be deprived of many of the pleasures enjoyed by those on shore.

Boys therefore should not decide to enter upon a career at sea until they have given the matter careful consideration. Those who are not prepared to accept its limitations should certainly remain ashore; but the keen boy who is eager to see something of the world, and has a real love for the sea, will ignore the risks and hardships. Such a boy will find that a sailor's life offers full scope for his talents. Fortunes are not made at sea, and, as is the case with shore occupations, there are periods of depression during which posts are difficult to secure. Generally speaking, however, the Merchant Navy offers a good living to those who are competent and determined to succeed.

Although it is possible to enter the Merchant Service by direct apprenticeship, many of the large shipping companies that offer the best prospects of advancement take only boys who have graduated from one of the recognised training ships or colleges. Undoubtedly the best plan for a boy who wishes to go to sea is to enter one of these institutions, for those who have successfully gone through the courses of training provided receive special consideration from practically every shipping company in the country, and the time spent in this manner counts as the equivalent of one year's service at sea.

A FAMOUS LINER CAPTAIN

Sir Arthur H. Rostron, K.B.E., R.D., R.N.R., Commodore of the Cunard Steam Ship Company's Fleet, entered the Merchant Navy from the Cadet School Ship H.M.S. "Conway." He joined the Cunard Company in 1895 and received his first command in 1907.

Sir Arthur has had charge of many famous vessels, including the "Carpathia," and the "Mauretania." When Captain of the "Carpathia" he was awarded the U.S. Congressional Medal of Honour and has received numerous other awards in recognition of rescues effected by him at sea. He was knighted in 1926. Sir Arthur has been Commander of the "Berengaria" since 1928, when he became Commodore of the Cunard Fleet, and is shortly going to retire.

The chief training centres for officers in the Merchant Navy are H.M.S. "*Conway*," H.M.S. "*Worcester*," and the Nautical Training College at Pangbourne, Berks. The "*Conway*" and the "*Worcester*" are moored in the Mersey and the Thames respectively. Both were in the British Navy in the pre-ironclad days, the "*Worcester*" being the former battleship "*Frederick William*," and the "*Conway*" the "*Nile*." Actually three vessels in turn have been employed as training ships in the Mersey, each under the name of "*Conway*." The first was a 28-gun frigate that was converted into a school in 1859, and the second a larger frigate that was requisitioned two years later in order to accommodate the growing number of boys who wished to undergo training.

Both the "*Worcester*" and the "*Conway*" are fitted with modern appliances and are well ventilated and lighted. The cadets, as the boys undergoing training are called, perform as far as possible the same duties as in sea-going vessels, and the enjoyable and healthy time they spend is a useful preliminary to actual life afloat.

The Nautical Training College, Pangbourne, is a more recent development, for it was founded in 1917. It is conducted in the spirit associated with English public schools. The full course extends over three years, and a considerable proportion of the time devoted to studies is spent in acquiring a knowledge of technical subjects.

At all three institutions the cadets are given a thorough grounding in mathematics and science, and also in the technical subjects peculiar to the career they intend to follow. These include navigation, and practical seamanship in all its branches; and now that sail has almost completely given way to steam, a special point is made of engineering instruction. A regular routine is followed, and discipline is enforced as a preparation for the responsibilities of life in the Merchant Navy.

The fees at these three training schools are rather high. They amount to £120 a year for the course given on the "*Conway*," and about £140 a year for that on the "*Worcester*," but in the latter case the cost of uniform is included in the fees. Attendance at Pangbourne Nautical College is a little more costly, the fees being at the rate of £160 per year. The age of entry into the "*Conway*" is from 13 to 17, and full particulars in regard to the course may be obtained on application to the Captain, Cadet School Ship, H.M.S. "*Conway*," Rock Ferry, Birkenhead. Cadets enter the "*Worcester*" between the ages of 11 and 16 years, and full information may be obtained by writing to the Captain-Superintendent, H.M.S. "*Worcester*," Greenhithe, Kent. In the case of the Nautical College, Pangbourne, details may be obtained from the Secretary.

For those who are unable to pay the fees required at one of these institutions, an alternative is to obtain entry to the "*Mercury*." This is an excellent school of nautical training that has been established on the River Hamble at Southampton. The work is carried on partly on land and partly on water. The buildings of the school stand on 45 acres of ground, and the training afloat is given in an old warship, H.M.S. "*President*." Boys of good character between the ages of 12 and 15½ are eligible for admission, and the training is specially designed to enable boys to qualify for entry into the Royal Navy as advanced class boys, or to join the Merchant Service as cadet apprentices.

This naval school was founded for the purpose of training and educating boys for petty officer rank in the Navy, with a view to their taking advantage of the opportunities now given for securing

commissions. It is under the inspection of the Admiralty and, as a Technical School, of the Board of Education also; and the training and education given are very thorough. The cost of the course is limited to the actual expenditure for training and maintenance, and at present amounts to about £65 per annum.

The boys of the "*Mercury*" are drawn from a good class, and the training given fits them for many careers on land, both at home and abroad, as well as for a life at sea. It is interesting to know that the management of the school state that as a rule no difficulty is found in placing the boys when they have completed their courses.

On the completion of training in one of the Nautical Schools it becomes necessary to obtain suitable employment with a shipping firm. This may be done by application to firms that specially favour boys who have adopted one of the courses outlined, and it is advisable to submit the application at a very early date. The aspirant for a life at sea is taken on in the rank of midshipman, cadet or apprentice, and he is required to serve for three years in foreign-going vessels. The normal period is four years but, as we have already pointed out, the time spent in a training school is allowed to count in place of one year's service at sea.

It is not absolutely necessary to enter the Merchant Service through a training school, for there are many shipping firms that take direct apprentices. In some cases premiums are payable, but quite moderate sums are asked for, 50 guineas being about the maximum, and this is usually returned on completion of indentures. The tendency is to dispense altogether with premiums, however, and an interesting scheme has been developed by the Shipping Federation Limited. Apprentices indentured under this scheme are not required to pay any premium. They receive wages during their period of four years of service, commencing with 10/– weekly and rising to £1 per week in their last year. A list of shipowners in the United Kingdom who engage apprentices or cadets on these terms may be obtained from the Shipping Federation Limited, 52, Leadenhall St., London, E.C.3, or from the Editor of the "*M.M.*," who will be pleased to give readers information on this or any other point in regard to apprenticeship.

It should be pointed out that good eyesight and correct colour vision are absolutely essential for a life at sea. No boy therefore should begin preparations for a career in the Merchant Navy, or even think of doing so, unless he is assured that he can pass the stringent tests imposed. The best plan is to undergo the Board of Trade sight test. Eyesight examinations are held at the Mercantile Marine Offices at most of the important seaports of the country. A small fee is charged, and full details of the times and places at which the examination can be taken may be obtained from the Board of Trade, or from the Editor of the "*M.M.*"

After serving for the specified four years—or, in the case of those who have attended a recognised training ship, three years—the apprentice may sit for the examination for his Second Mate's "ticket." If he is successful in obtaining this he is eligible for a position as deck officer with a shipping company, and has taken the first step towards attaining a responsible position.

In studying for his ticket the boy who enters the Merchant Navy by direct apprenticeship is at some disadvantage in comparison with one who has been through a Nautical School. He must study for himself the various subjects of the examination, and naturally he will not have as good opportunities as his more fortunate colleagues, particularly if he is stationed with the crew during the period of his apprenticeship. The officers under whom he serves are usually quite willing to help him, but they are busy men, and to a large extent the apprentice must rely upon his own endeavours and determination to succeed. In his preparation he may be greatly helped by attending technical schools dealing with nautical matters, during his periods of life in home ports.

After obtaining a Second Mate's certificate, the next step is to qualify for the rank of First Mate. Candidates for this must be not less than 19 years of age, and must have completed a period of five years' service at sea. It is essential that one year should have been passed in a capacity not lower than Fourth Mate of a foreign-going vessel, and if the applicant has served as Third or Fourth Mate, he will be required to show that he has had full charge of a watch from port to port throughout the whole year.

The final examination to be passed by an officer in the Merchant Navy is that which qualifies him for Mastership of a vessel. This he may take when he reaches the age of 21 years, and has served for six years at sea, the later years of service having been passed in positions of responsibility. The regulations cover various phases, being specially adapted to include not only those engaged in foreign-going vessels, but also the men who serve in home trade or coasting vessels. Fees ranging from 10/– to £4 are payable for the examinations, and the complete regulations may be obtained from any of the nautical publishers, a list of whom will be supplied on writing to the Editor.

Courtesy] [*Cunard Steam Ship Co. Ltd.*

Officers "taking the Sun" on board the "*Berengaria*" while an interested passenger looks on. There are no signposts on the seas and a ship's position and route must be worked out from observations of the Sun.

The aim of every deck officer should be not merely to obtain an ordinary Master's ticket, but to secure what is called the Extra Master's ticket. This enables the holder to take charge of any vessel, either sail or steam; and its possession, together with a good record, is a guarantee of complete efficiency.

It is impossible to give any definite figure for the salaries received by merchant officers, for these vary according to the class of vessel and the trade engaged in. A substantial increase in pay has been made in recent years, however. Junior officers with a Second Mate's ticket might expect to start at about £120 or £150 per year. Pay varies with promotion and increase in responsibility, and those who rise to the command of large vessels may receive from £1,000 to £1,500 per annum, or even more.

Improvements in general conditions also have been carried out during the past few years. The most notable of these are in regard to holidays, accommodation and superannuation. In many of the first-class liners annual leave is now granted on full pay, while the compulsory retirement of commanders on reaching a certain age has provided better opportunities for promotion.

When the deck officer decides to settle down on shore, there are numerous openings for him. The positions most sought after are those as marine superintendents of big companies, shipping agents, harbour masters, dock masters, pilots, Board of Trade officials, Lloyd's agents and surveyors. The Brethren of Trinity House, who are responsible for the efficient lighthouse arrangements round our coast, also are all ex-merchant sailors. These posts demand practical experience at sea in addition to a thorough knowledge of one or more branches of marine architecture or surveying, and many of them are highly responsible and carry good salaries.

Of the positions mentioned it is probable that the pilot service absorbs the most men. In this country there are many ports that require pilots, while there are also good opportunities in the pilot services of some foreign ports. The requirements of port authorities vary, and thus we find that the pilots of one port are former deep water sailors, while those at another have served a special apprenticeship on board the pilot cutters. The remuneration of a fully qualified pilot is good, and one employed in the London service could expect to receive as much as £500 per year, after all travelling expenses had been paid.

From Our Readers

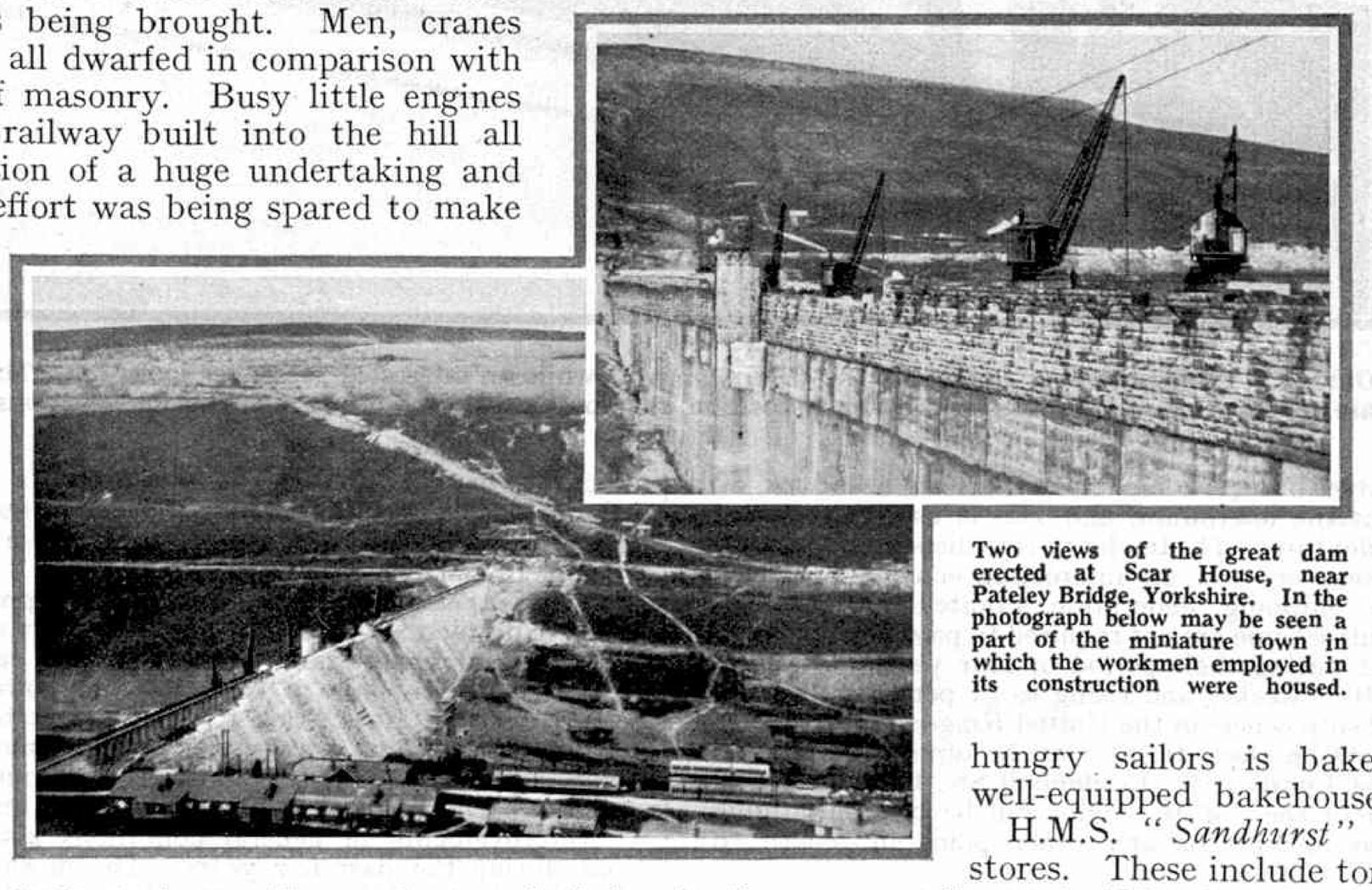
These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A Visit to Scar Dam

When camping out near Pateley Bridge, and only about ten miles distant from the great new dam now being built in the Nidd Valley at Scar House, my friends and I decided to go and see it, and try to obtain some photographs.

We set out one morning on our bicycles and after walking up some very steep roads, impassable to cars, reached an elevated position from which we obtained a fine view of the dam several hundred feet below. From there we could also see the great quarries on the opposite hillside, from which the stone used on the dam was being brought. Men, cranes and engines were all dwarfed in comparison with this huge mass of masonry. Busy little engines and a funicular railway built into the hill all gave the impression of a huge undertaking and one in which no effort was being spared to make it a success.

On descending to the level of the dam we noticed in it great cracks that were being filled up. These cracks had occurred owing to the sinking of the foundations, which had not stood up to the tremendous weight. A large number of houses had been built to house the workers and their families, and among them were shops, play-grounds and even a picture-house. Indeed, the community could be described as a complete town on a small scale, and it is lighted by electricity generated on the spot. It seems a pity that the miniature town will ever be abandoned, but that will be its fate when the great dam has been completed, and an enormous lake with a surface area of 170 acres has been formed.



Two views of the great dam erected at Scar House, near Pateley Bridge, Yorkshire. In the photograph below may be seen a part of the miniature town in which the workmen employed in its construction were housed.

We returned home by a different route that itself was of great interest, for running alongside the road for six or seven miles was a railway right up to Scar from the L.N.E.R. terminus at Pateley Bridge. In places the line appeared too steep for an ordinary adhesion locomotive but soon we were convinced that this was not the case, for a little 0–6–0 saddle-tank came along, gaily puffing its way to the summit with its retinue of loaded trucks. In England a railway running on the road is a most uncommon, if not unique sight.

B. UNNE (Harrogate).

A Floating Store

H.M.S. "*Sandhurst*" is the parent ship for the destroyer flotillas of the Mediterranean fleet and supplies the needs of four flotilla leaders and 38 destroyers. She is a vessel of 11,500 tons and was originally designed as a grain carrier. Her engines develop 4,000 I.H.P. and give her a cruising speed of eight knots that may be increased to about 12 knots if necessary.

The vessel supplies the destroyer flotillas with provisions when these are absent from their base on a cruise. Meat for 4,000 men for about two months is carried in a large refrigerator at the after end of the ship, and enormous quantities of flour, jam, tinned beef, biscuits, dried peas and tobacco are stowed in her capacious holds. An idea of the resources of the vessel may be gained from the fact that at times sufficient bread to satisfy the appetites of 4,000 healthy and hungry sailors is baked daily in the well-equipped bakehouse on board.

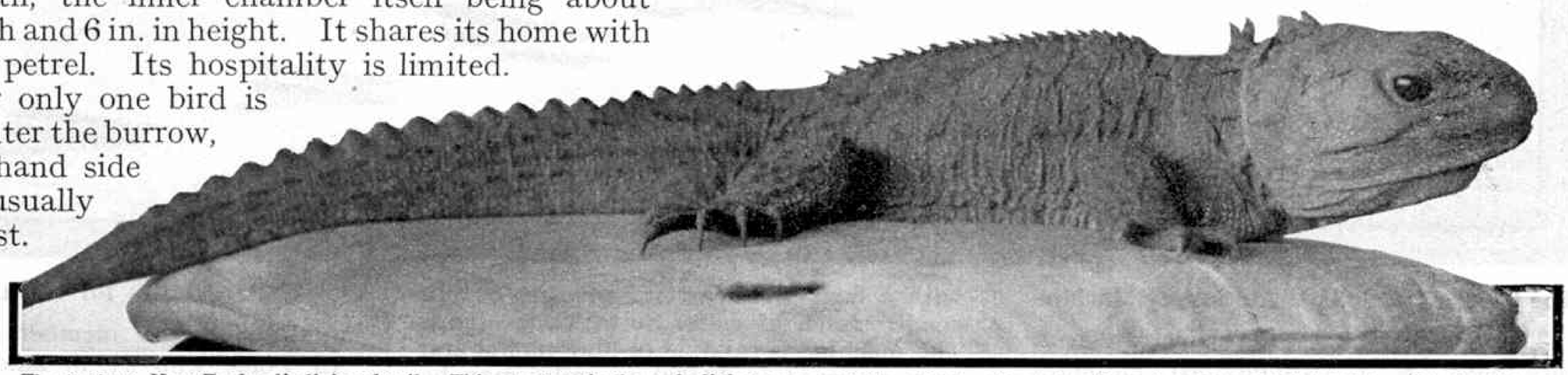
H.M.S. "*Sandhurst*" also carries war stores. These include torpedoes, of which there are usually nearly 150 on board. The warhead of each of these contains 300 lb. of high explosives and in the interests of safety the temperature of the magazine in which they are stored is measured twice daily! Shells for the guns of the destroyers also are carried in addition to those required for her own armament, which consists of four 4-inch guns and one 3-inch anti-aircraft gun. Her crew includes shipwrights, carpenters, plumbers, blacksmiths, electricians and other skilled craftsmen, who are constantly employed in the various workshops that have been fitted up.

It is interesting to note that the parent ship also undertakes the duty of providing amusement for the crews of the destroyers, and concert parties and cinematograph entertainments are frequently given on board. Below decks there is a sick bay, which contains a splendid operating theatre and is fitted with X-ray apparatus, and the vessel also boasts a church, in which the chaplain of the destroyer flotillas officiates.

E. I. PEDDLE (Plymouth).

A Weird Reptile

Of the many strange creatures that are found in New Zealand probably the most remarkable is the tuatara. This is a reptile that is about 18 in. in length. Usually its skin has a greenish tint, but the colour varies slightly according to that of its surroundings. The tuatara is nocturnal in habit, sleeping during the day and at night searching for its food. It lives in a burrow approached by a passage two or three feet in length, the inner chamber itself being about 12 in. in width and 6 in. in height. It shares its home with a bird—the petrel. Its hospitality is limited. however, for only one bird is allowed to enter the burrow, on the left hand side of which it usually builds its nest.



The tuatara, New Zealand's living fossil. This creature is the only living representative of an early stage of the development of reptiles. Its slaughter is strictly forbidden, but the species is dying out, and threatens to become extinct.

In captivity the reptile is a model of laziness, for it rarely moves. It finds difficulty in supporting itself on its legs and usually slides along the ground, the scales on the under part of its body being very thick. When chasing its prey it can lift its body and run, but after covering three or four yards it grows weary and stops. It is most at home in the water. It seems to be capable of holding its breath for hours and is able to remain submerged for incredibly long periods.

Nowhere else in the world can creatures similar to the tuatara be found living to-day. It represents an early stage in the development of reptiles and as other lizards of the same type have long been extinct it may be regarded as a living fossil. For this reason the tuatara is specially protected and any person who kills one without authority is liable to a very heavy fine. In spite of this precaution against its destruction the species seems to be dying out.

J. G. HOWARD (New Zealand).

Interesting Table Top Photography

My friend and I spent an interesting morning in making arrangements for securing a photograph of a fake aeroplane crash. We began by constructing a "field," the "grass" of which consisted of a piece of green baize tightly stretched and fixed in position by means of drawing pins. This was enclosed by fencing purchased from a toy shop and a hedge was made of small pieces of an evergreen shrub. Larger pieces of the shrub represented the trees that may be seen in the accompanying photograph, with the exception of the one in the background, which is made of lead. The hills in the distance were made by stretching green baize over books, this with the toy house completing the scenery.

The plane that was supposed to have crashed was a model of a military machine that had become somewhat dilapidated. We crushed and bent the nose of the machine and the tip of one wing, and strewed small pieces of wood around in order to represent wreckage. A small model of a monoplane was suspended by means of cotton in order to give it the appearance of flying to the rescue, and a leaden motor cyclist hurrying to the scene of the accident also was introduced.

In order to photograph the scene as finally arranged a piece of linen cloth was used as background and reflectors were arranged to give light where needed. The result was a photograph that at first sight appears to be a representation of an actual crash. Its production afforded great enjoyment to both of us and undoubtedly table photography of this kind is capable of great variety.

L. M. SIMONDS (Bromley).

A realistic "fake" photograph of an aeroplane crash. How this was taken is explained in an article on this page.

Through South Africa's Game Reserve

Recently my father and I decided to visit Kruger National Park, a wide expanse of country on the eastern frontier of the Transvaal, in which lions, elephants and other characteristic African animals may live without fear of being hunted. We motored from our village in the heart of Kaffir Land to Durban, a distance of 350 miles, and there we boarded a vessel that took us to Lourenço Marques. The train then took us to Nellspruit, and from there we travelled by car to the Game Reserve.

On reaching the National Park our car was searched for firearms and if any had been found these would have been sealed. We had scarcely entered the Reserve when we encountered a large herd of wildebeest and zebras. These were quite near the road and did not seem at all disconcerted by our presence. Apparently zebras are always accompanied by wildebeest, and it is said that this is because the zebras have a sharper sense of smell and give earlier warning of the approach of enemies. As we passed through the Park we met many herds of koodoo, sable antelope, and waterbuck in addition to more wildebeest and zebras. While travelling through the Park next day we were suddenly startled to see a huge lioness walking across the road in front of the car. During our tour we also saw three giraffes and nine hippopotamuses. They were not disturbed by our approach and the animals in the Park seem to know that they are immune from attack.

B. WARNER (Grahamstown, South Africa).

The Gloster "A.S. 31" Air Survey Machine

The Gloster "A.S. 31," illustrated on this page, is a twin-engined all-metal biplane and is the first to be designed for aerial surveying. Work of this kind is very exacting, especially when carried on in undeveloped regions, and the use of a special type of machine is desirable if the greatest efficiency is to be secured. It is interesting to note that the Aircraft Operating Company employed the "A.S.31" when surveying an area of 63,000 sq. miles in Northern Rhodesia.

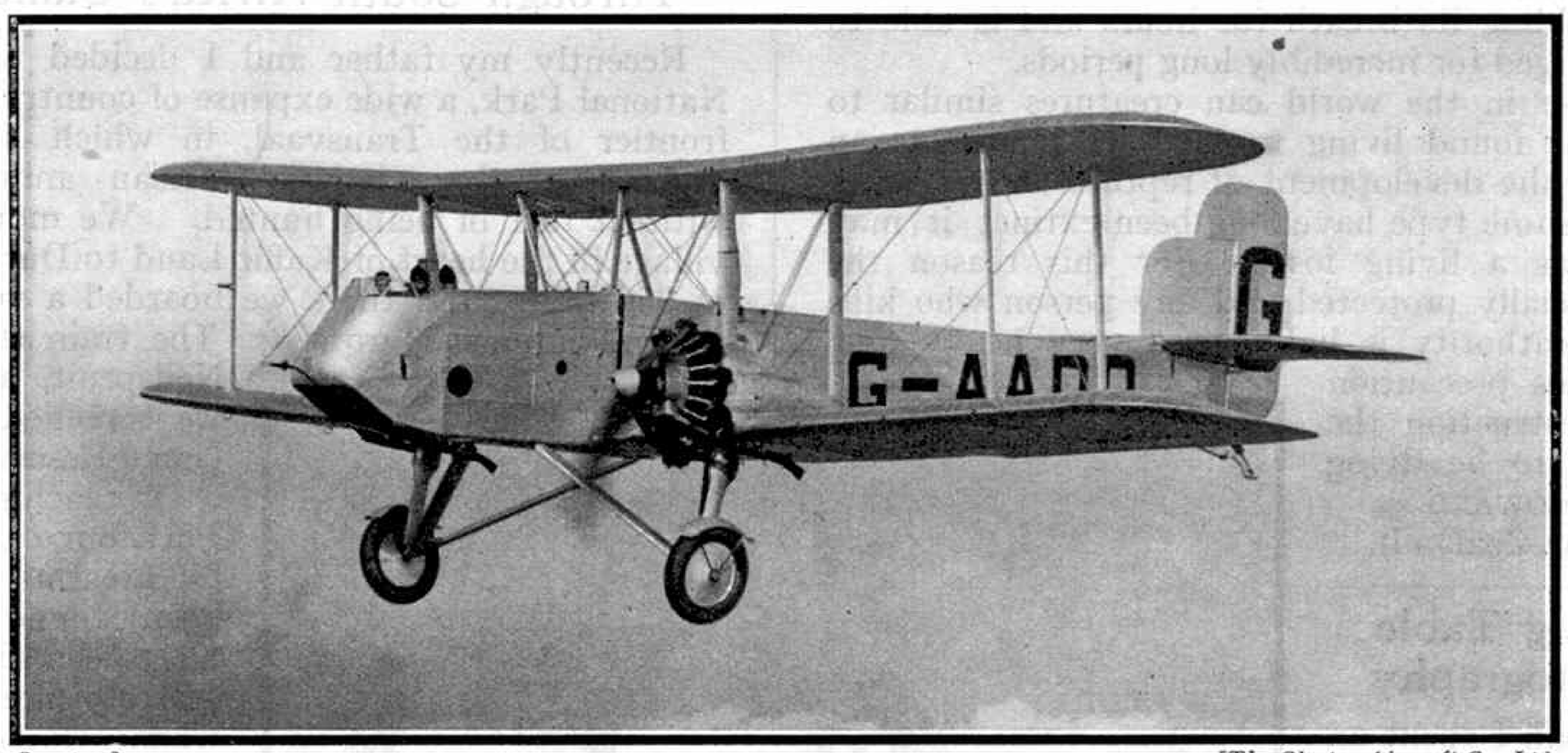
The control cabin of the "A.S. 31" is built on unusual lines in order to make the machine specially suitable for its intended purpose. A mounting for a survey camera is directly under the pilot's downward line of vision, and the front portion of the floor slopes upward and is of glass in order to provide a clear view of the ground being surveyed. The cabin has also been designed to give uninterrupted vision over a wide angle.

The machine is fitted with Bristol "Jupiter" XI geared engines. It is very reliable, and the power is adequate to maintain flight on one engine only when fully loaded at a height of 9,000 ft. When a twin-engined machine is flying with only one power unit in operation, a considerable yawing movement is set up and the effort of holding the machine on a straight course is very trying for the pilot. For this reason the controls of the Gloster machine have been designed to operate automatically against this yawing movement, and even when one engine is stopped the machine flies in a normal manner.

Another feature that makes the "A.S. 31" particularly useful for air survey work is that it has very short take-off and landing runs. It is therefore able to make use of small landing grounds, and when fitted with a float undercarriage requires only a small stretch of water on which to alight. The machine is capable of long flights and areas as great as 30,000 sq. miles may be surveyed from a single base.

The normal weight of the crew and survey load of the machine is 1,000 lb. and with the additional weight of 200 gallons of fuel and 27 gallons of oil, the Gloster "A.S. 31" has a guaranteed maximum speed of 140 m.p.h. at a height of 1,000 ft. At a height of 20,000 ft., which is the service ceiling, the maximum speed is 116 m.p.h. The absolute ceiling is 21,000 ft. and the stalling speed is 47 m.p.h.

The machine is capable of a flight lasting 4½ hrs. at a speed of 110 m.p.h. and a height of 1,000 ft. When required to operate over greater distances, 240 gallons of fuel and 31 gallons of oil may be carried in addition to the crew and the usual survey load. The extra weight then carried has no effect on the maximum speed at a height of 1,000 ft., but when flying at a height of 20,000 ft., the speed is reduced to 113 m.p.h. The endurance at a speed of 110 m.p.h. and at a height of 1,000 ft. is increased to 5½ hrs., however, while at a height of 20,000 ft. and at a speed of 100 m.p.h. this becomes seven hours. When carrying the extra fuel and oil necessary to increase the radius of action, the service ceiling of the "A.S.31" is reduced to 19,000 ft. and the stalling speed increased by 1.5 m.p.h.



Courtesy] [*The Gloster Aircraft Co. Ltd.*

The Gloster "A.S.31" survey machine in flight. The glass bottom in the front section of the cockpit may be seen plainly. The wide track undercarriage and the absence of an axle enables the machine to be landed safely on rough and uneven ground.

Parachutes for Naval Airmen

Although the members of the Royal Air Force who fly in land machines are required to wear parachutes, it has not been the custom for pilots employed in the Fleet Air Arm to do so. The reason for this was that it is not easy to get out of the ordinary type of harness by means of which a parachute is attached to its wearer, and there was grave risk that a pilot who alighted in the sea while encumbered with this would be drowned before he was able to release himself. A new type of quick release harness introduced by the Irving Air Chute Company avoids trouble of this kind and the Fleet Air Arm is to be equipped with parachutes employing it.

The new harness makes use of straps of standard type, but these fittings are connected together at a single point in front of the harness. When the wearer wishes to free himself from it, he simply releases the easily-moved fitting in front and the harness falls off. A special type of back pad fitted to the quick release harness makes it comfortable to wear and adds to the ease with which it may be put on.

Blimps Fly 254,000 Miles

The Goodyear Zeppelin Corporation of Akron, Ohio, announce that during the first ten months of last year the six vessels constituting their fleet of Blimps travelled about 254,000 miles, and carried more than 31,000 passengers without serious mishap to a ship or the slightest injury to a passenger. These airships were described on page 781 of the "*M.M.*" for October, 1930, and their records show that confidence in the safety of airships is growing. Helium is used in the Goodyear Blimps and thus the danger of fire—the greatest of airship risks—is minimised.

New Armstrong Siddeley Aero Engines

Two new Armstrong Siddeley aero engines made their first appearance at the Paris Aero Show last month. They were the 140 h.p. 7-cylinder "Genet Major," and the 350 h.p. 10-cylinder "Double Mongoose." The 7-cylinder "Genet Major" has cylinders of the same size as the well-known "Genet Major," which was fully described on page 776 of the *"M.M."* for October 1929, but the number of these has been increased from five to seven, thus raising the output from 100 h.p. to 140 h.p. The new engine is particularly suitable for use in aircraft of the 5–7 seater type, and also for service in certain single-engined sporting light aircraft.

The "Double Mongoose" may be regarded as one of the "Jaguar" range of engines, for it is composed of ten cylinders of "Jaguar" size arranged in two banks. It thus maintains a wide range of interchangeability with the "Jaguar" series. Its rating is 350 h.p. and it has been produced for use when three ten-cylinder engines are to be preferred to two having 14 cylinders. Each cylinder measures 127 mm. by 139.7 mm. and has a capacity of 17.72 litres. The engine is of the geared type and is fitted with a paddle fan.

In addition to the engines already mentioned, Armstrong Siddeley Motors have produced a third new engine, the "Lynx Major." This engine bears the same relation to the "Lynx" that the "Jaguar Major," or "Panther," as it is called in the Royal Air Force, bears to the "Jaguar." The "Lynx Major" is a seven-cylinder engine of 260 h.p. with cylinders having a cubic capacity of 13.66 litres as against the 12.4 litres of the ordinary "Lynx." Many of its parts are interchangeable with those of the "Jaguar Major," thus reducing the number of spares needed by owners of engines of both types. The engine is fitted with a geared supercharging fan so that its rating of 260 h.p. is reached at an altitude of 2,500 feet at 2,000 r.p.m. On the ground it develops a maximum of over 300 h.p.

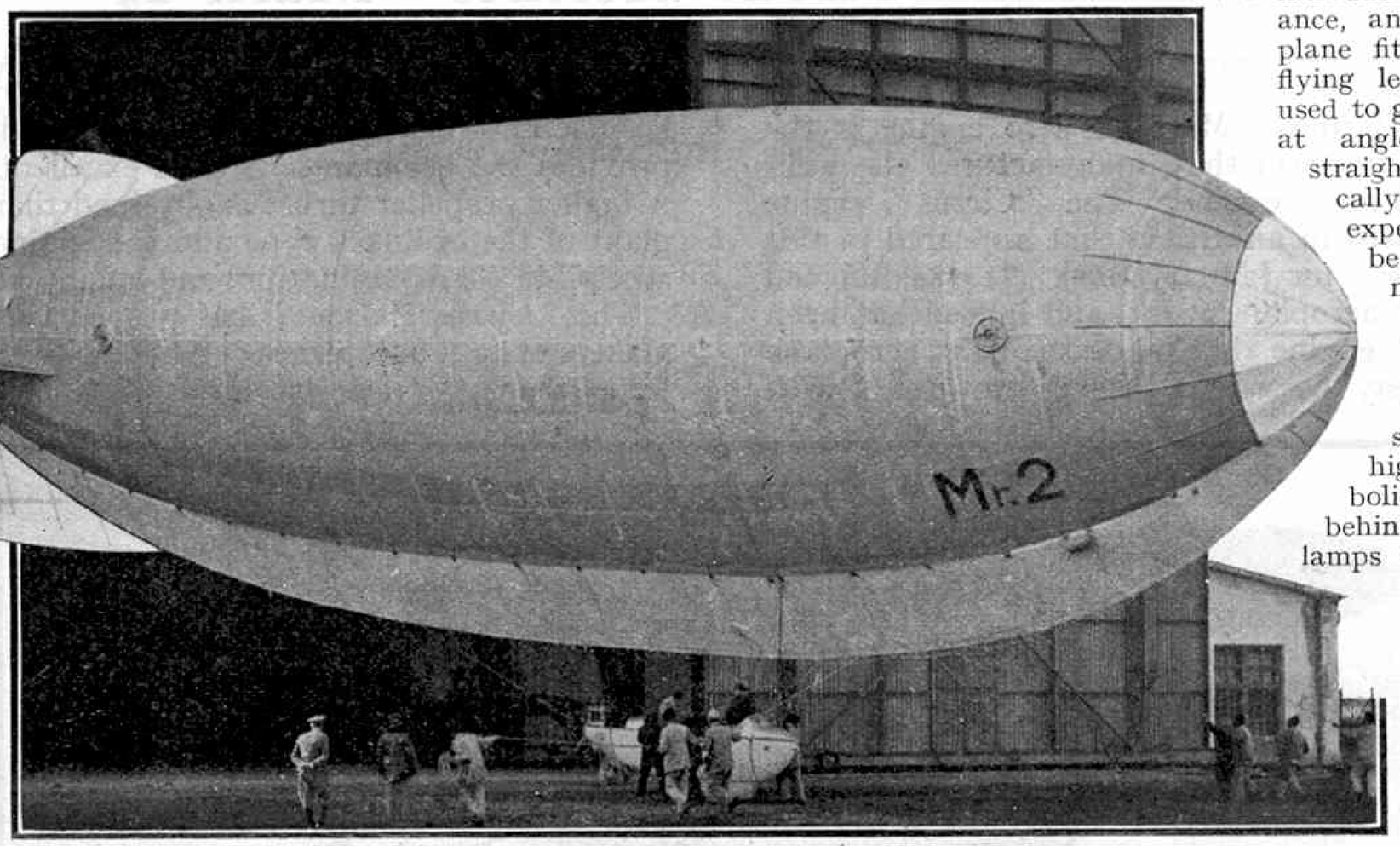
* * * *

A scheme for the construction of a Municipal Air Port is now being proceeded with at Birmingham. The proposed site is 200 acres in area, and the work necessary is expected to cost about £70,000.

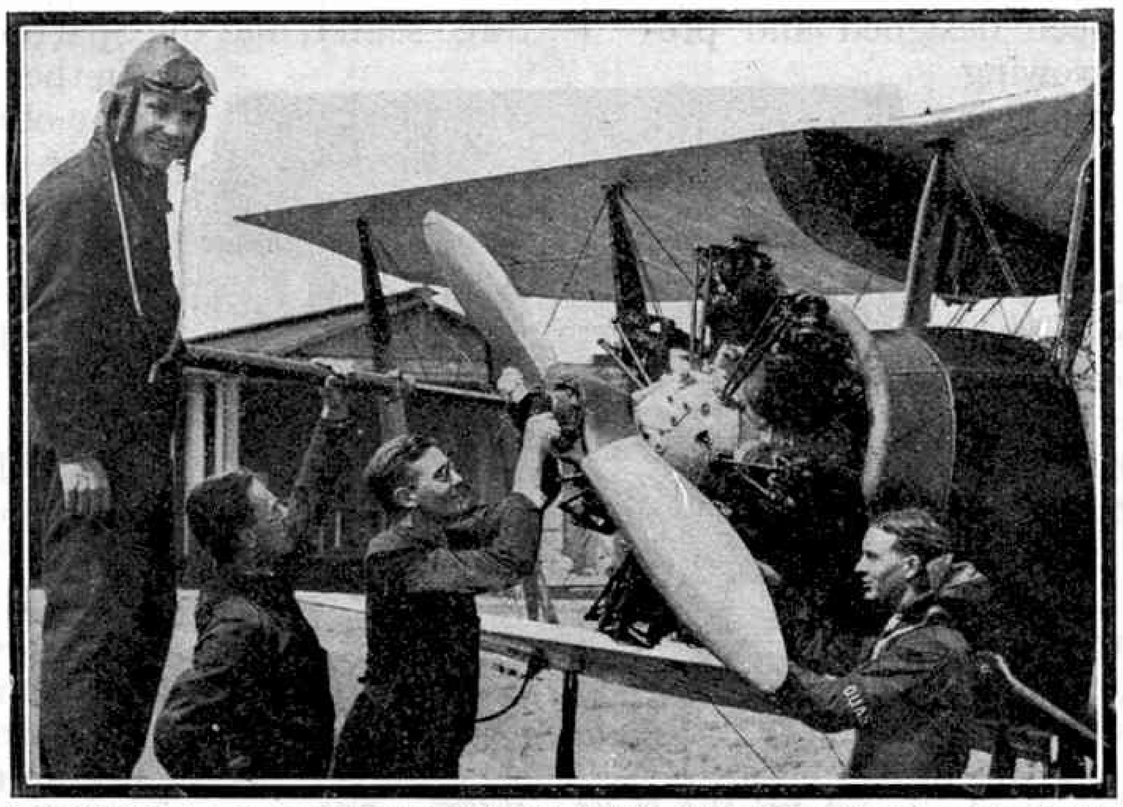
The London-Cape Town Air Route

Before the air route from London to Cape Town is ready for service, the cost of preparation will have reached about £1,000,000, or £125 per mile. Nearly half the money has been spent on new machines, for altogether the giant air liners and the flying boats that are to be employed will cost more than £400,000.

In order to enable the service to be flown in perfect safety 27 aerodromes have been prepared in Africa, and in addition there are 30 emergency landing grounds. All the emergency landing grounds will be fully equipped with apparatus likely to be required by machines compelled to land. Hotels have been built at nine of the main aerodromes, and at all of them wireless apparatus will be installed. A staff of at least 400 men will be required in addition to the pilots, and in preparation for the opening of the new service the men chosen have undergone an extensive course of training at Croydon. All of these men will not be required at first as a service to Kenya and Uganda will be opened before the main London-Cape Town service.



The world's smallest airship. Our illustration shows the "Bebe," a small dirigible of 1,000 cubic metres capacity, built for the Italian Government. It is about 22 yds. in length and carries only the pilot and one passenger. A 40 h.p. motor is fitted.



Members of the Oxford University Air Squadron attaching a Hucks starter to the propeller boss of one of the Squadron's machines.

Wing Landing Lights for Night Flying

Increased safety when flying at night will result from the general employment of a new type of aeroplane wing landing lights produced by the General Electric Company of New York. These are fitted into the wings themselves in order to avoid introducing extra air resistance, and when an aeroplane fitted with them is flying level they may be used to give beams of light at angles ranging from straight ahead to vertically downwards. It is expected that they will be installed on a number of American Air Line machines.

The light units are practically searchlights, for highly polished parabolic mirrors are fitted behind the 420 watt lamps used in order to concentrate the rays into an intense beam. A special type of glass is used that transmits a very large proportion of the light and does not deteriorate with age. A complete installation includes two of the units, one being fitted in the leading edge of each wing. They are so placed that there is no reflection of light from the propellers to mislead the pilot and they are provided with dust-tight and weather-proof covers.

Aerial Ferry at San Francisco

The aerial ferry service across the Bay of San Francisco mentioned on page 436 of the *"M.M."* for June, 1930, has now been greatly improved and extended. When the service was inaugurated the machines alighted on the water at each side of the Bay and passengers were transferred by means of boats. Much time is now saved by the use of special floats moored to the quays. On alighting, the Keystone-Loening Amphibians employed simply taxi up to the floats and the passengers may then make their way to land without difficulty.

The service recently completed its first six months of operation. During that time 46,000 paying passengers were carried, the gross revenue being more than £18,000. Four machines are employed. Each of these is equipped with a 525 h.p. Pratt and Whitney "Hornet" engine. They make 60 trips across the Bay daily and in addition are available for hire for pleasure flights and special charter work.

Liverpool–London Air Service

As readers will no doubt be aware, an air service connecting Liverpool, Manchester and Birmingham with London was run experimentally for three months in the summer of last year. The experiment was so successful that Imperial Airways hope to inaugurate a regular service.

Famous Aero Engines

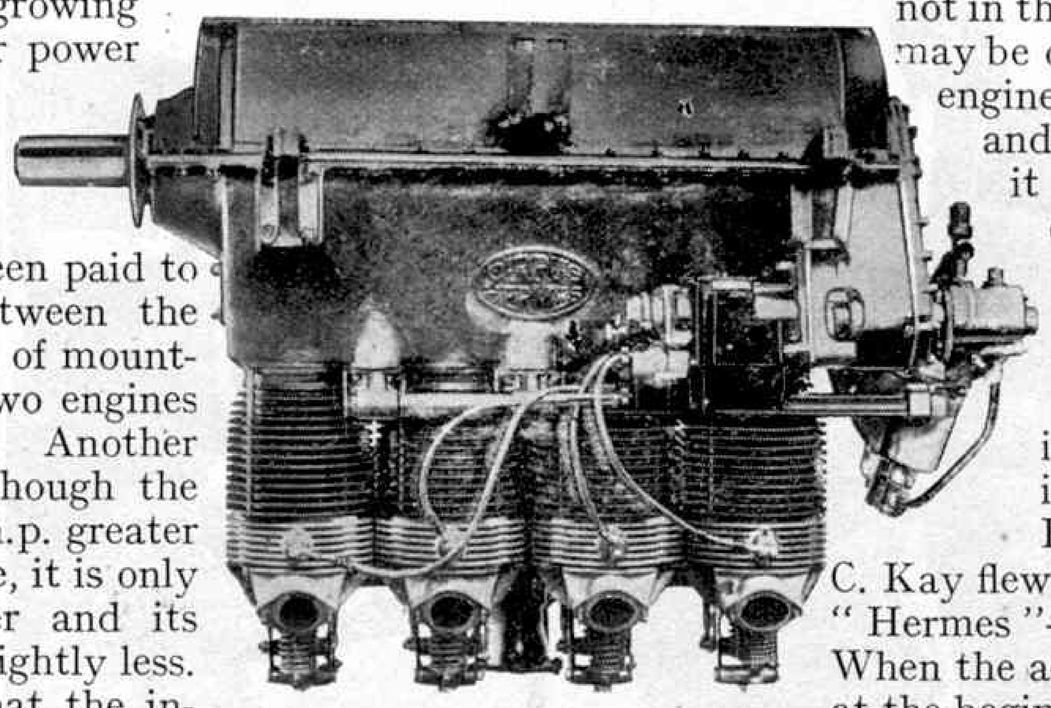
XIV.—The "Cirrus Hermes" Mark II

THE "Cirrus Hermes" Mark II aero engine is the product of the firm that manufactures the well-known "Cirrus" engine. The "Cirrus" engine itself was dealt with in an article that appeared in this series in the "*M.M.*" for January 1930. It was designed specially for light aeroplane work, and indeed has been described as the "engine that made the light aeroplane possible." It may be said to have grown up with the light aeroplane movement, for in its original form it was an engine of only 27–60 h.p. Its manufacturers have kept pace with developments and in succession have designed the "Cirrus" Mark II and the "Cirrus" Mark III engines for use in the light aeroplanes of improved construction and greater strength that have since been produced. The Mark III engine is rated at 85/95 h.p. and has proved to be one of the most reliable aero engines ever made.

Courtesy] [*Desoutter Aircraft Co. Ltd.*

The "Hermes"-engined Desoutter cabin monoplane. The clean lines of the machine are well shown in this photograph.

The "Cirrus Hermes" has been designed and produced in order to meet the growing demand for an engine of higher power than the standard "Cirrus." It includes many improvements, but still retains most of the outstanding features of the older engine. Special attention has been paid to interchangeability of parts between the two types and the same method of mounting has been adopted for the two engines in order to assist in this respect. Another noteworthy feature is that, although the output of the "Hermes" is 20 h.p. greater than that of the Mark III engine, it is only a little more than 2 in. longer and its overall height is actually very slightly less. It is also interesting to find that the increase of power has not been gained at undue cost in weight, for the "Hermes" is only 15 lb. heavier than the "Cirrus" Mark III.



A side view of the "Hermes" Mark IIB engine. This engine develops the same power as the Mark II, but is more convenient for service in certain types of aeroplanes, as it provides a better forward view.

In addition to the "Cirrus Hermes" Mark II, an inverted edition of the engine known as the Mark IIB has been produced. This is intended for use in the cabin monoplanes of the high wing type, such as the Desoutter or the "Puss Moth," that represent the most recent developments in the design of light aeroplanes.

In machines of this kind the use of an inverted engine provides the occupants with an excellent forward view. A higher propeller thrust is obtained than with a power plant of the ordinary type and the engine is more easily accessible for examination and maintenance.

The "Cirrus Hermes" has proved very popular with makers of light aeroplanes. At present about 22 types of these machines are produced in this country, these ranging from small single seaters, of which the Comper "Swift" is a typical example, to comparatively large flying boats, such as the Saro "Cutty Sark," which accommodates four people. Of these 22 machines, no fewer than nine may be obtained fitted with the "Hermes" engine. They are the Blackburn "Bluebird," the Desoutter Mark I, the Hendy 302, the Parnall "Elf," the Avro "Sports Avian," the "Avian" monoplane, the twin-engined "Cutty Sark," the Spartan three-seater, and the Spartan "Arrow." Other machines, not in the light aeroplane class, that also may be obtained fitted with the Hermes engine are the Hawker "Tom-Tit" and the Westland limousine, and it is installed in quite a number of aeroplanes of foreign manufacture.

The capabilities of the "Cirrus Hermes" engine have been shown in many interesting flights. For instance, in the early part of last year Flying Officers H. L. Piper and C. Kay flew from England to Australia in a "Hermes"-engined Desoutter machine. When the aeroplane took off from Croydon at the beginning of the flight, it was loaded up to 2,000 lb. instead of the usual 1,800 lb., but a cruising speed of 102 m.p.h. was obtained without difficulty and the engine gave complete satisfaction.

Another excellent flight in a "Hermes-Desoutter" was that of Mr. C. Bernard Wilson to Baghdad and back. Mr. Wilson covered a distance of about 5,500 miles in 62 hours' flying time, and a great part of the journey was made under conditions that were very trying for an air-cooled engine. Mr. Wilson's machine took part in the

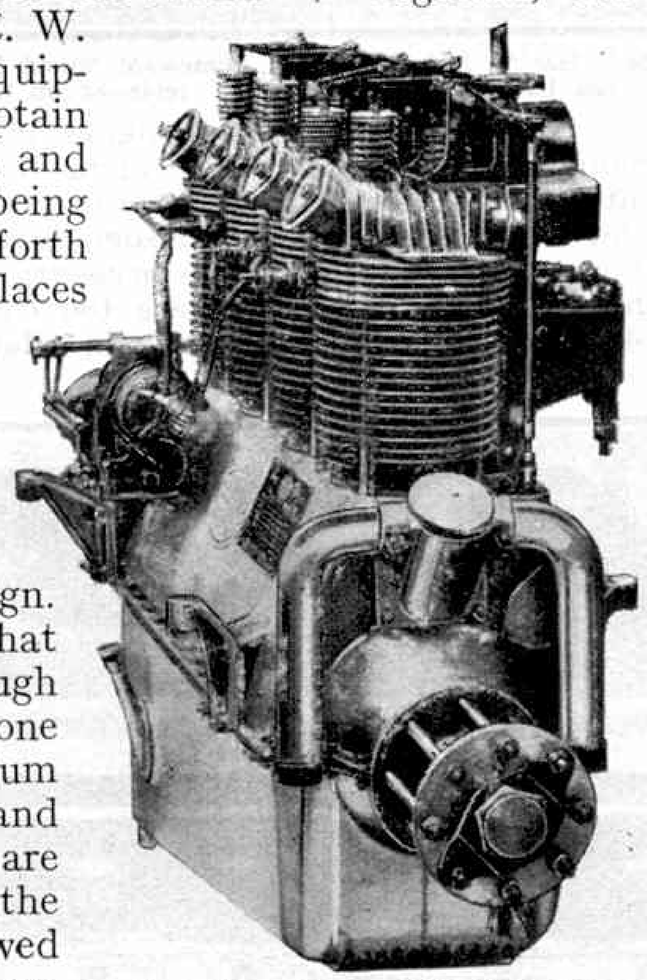
King's Cup race of 1930, only a week after his return from Baghdad. During the whole of this race the engine was run at full throttle, but this hard treatment has had no ill effects on it, for it is still in use and is giving satisfactory service.

The reliability of the "Hermes" was fully demonstrated in the 1930 race for the King's Cup. Six of the first twenty-five machines were fitted with "Hermes" engines, while five others made use of "Cirrus" engines. The "Hermes" also has been well to the fore in other racing events. For instance, a number of "Hermes"-engined aeroplanes were entered in the last Challenge International de Tourisme, and a "Hermes-Avian," piloted by Mr. S. A. Thorn, gained full marks for regularity throughout the 4,700-miles circuit of Europe. In addition Mr. Thorn won the prize presented by the people of Paris to the pilot of the first machine to arrive at Orly, and his "Avian" was the third machine to arrive at Berlin on completion of the tour.

Courtesy] [*George Parnall & Co.*
The Parnall "Elf," one of the light aeroplanes that are fitted with a "Hermes" engine. This machine has a maximum speed at ground level of 116 m.p.h., and its cruising range is 400 miles at 103 m.p.h.

The "Hermes" also was very successful during the Grosvenor Challenge Cup event in 1930, for the fastest time of the day was secured by Captain E. W. Percival flying a Hendy 302 monoplane equipped with a "Hermes" engine. Captain Percival's average speed was 125½ m.p.h., and he secured third place in the event, being followed by Flight Lieutenant G. Stainforth in a "Hermes-Avian." The first two places were secured by Cirrus-engined aircraft.

The "Cirrus Hermes" Mark II is of the four-cylinder-in-line air-cooled type. The cylinders are of cast iron, heavily finned, and located in the crankcase by deep spigots. The aluminium cylinder heads are detachable and are of special design. They are held in place by long studs that project from the crankcase and pass through the cylinder fins. Each head contains one large inlet and exhaust valve, the aluminium bronze seatings for which are screwed and expanded into position. The valve guides are of phosphor bronze and are a force-fit in the head, while two bronze adaptors are screwed into the head to take the sparking plugs. The pistons are aluminium alloy castings and are each fitted with three piston rings of cast iron. The hollow gudgeon pins are of the fully floating type, which means that they are free to turn in the piston and in the small end of the connecting rod. They are located sideways by circlips.



The "Cirrus Hermes" Mark II. We are indebted to Cirrus Aero Engines Ltd. for this photograph and for the one of the inverted "Hermes" that appears on the previous page.

High quality steel stampings are required for the connecting rods, the stampings being carefully machined all over and balanced. Phosphor bronze bearings lined with white metal are provided in the big ends and movement is prevented by a dowel, or headless pin, secured in the connecting rod gear. The phosphor bronze bush is tightly pressed into the smaller end of the rod.

The alloy steel four-throw crankshaft is carried on five die cast bearings of ample dimensions, while a substantial journal ball bearing is fitted at the front to absorb the thrust of the propeller.

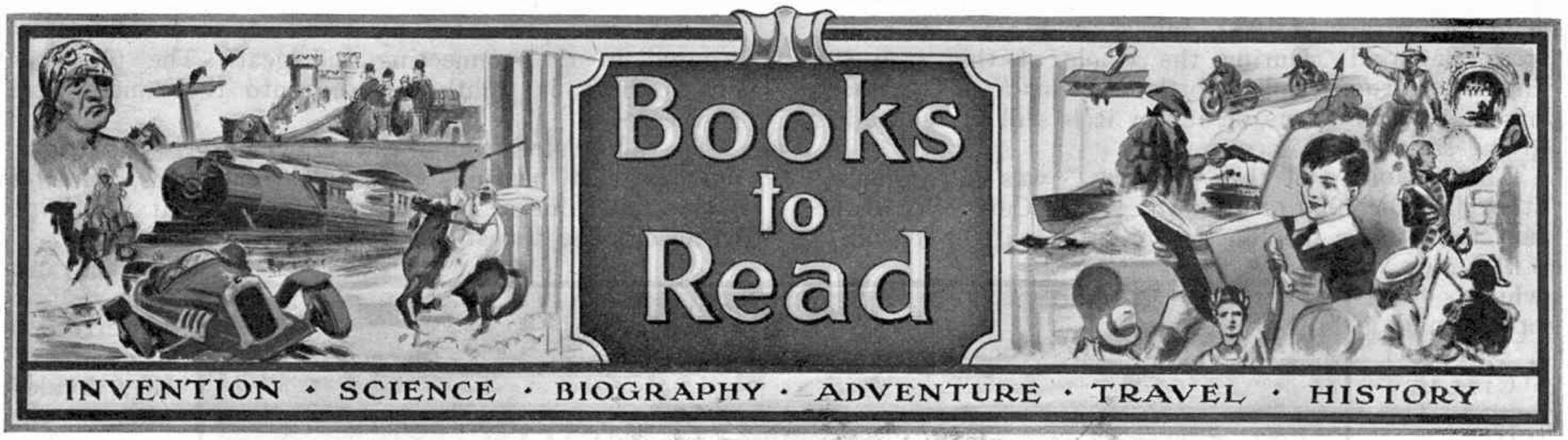
The crankcase is an aluminium alloy casting, divided along the centre line of the engine. The upper portion, which is suitably ribbed, forms the housing for the five crankshaft bearings, while all the timing gears are also carried in the same half at the rear end. By this means the necessity for accurate alignment of the timing gear cover and the lower half of the crankcase has been eliminated. The lower section of the crankcase merely acts as an oil sump and a cover for the moving parts, in addition to forming in itself a cap for the radial thrust bearings, while the cover of the timing gear retains the oil necessary for lubrication. The upper and lower portions of the crankcase are bolted together, the joint being effected by a brown-paper washer.

A one-piece camshaft, driven by a train of spur gears, is carried on five substantial bronze bearings fitted in the lower half of the crankcase. This camshaft operates the valves through the medium of tappets, push rods and rocking levers. A simple method of adjustment is provided.

Lubrication of the "Hermes" is of the wet sump type, and is very economical in action. The temperature of the oil is very much lower than usual in internal combustion engines and its viscosity is retained over a long period.

The engine is fitted with one Claudel Hobson type 48 D. carburetter, which is equipped with means of control to enable it to be used at high altitudes. The ignition system is of the dual type, each of the two magnetos fitted being driven by means of a vernier coupling. An impulse starter is fitted to each magneto, while the engine may be started easily on either of the two. Provision has been made for the engine to be fitted with hand or mechanical starters.

The "Cirrus Hermes" has an overall length of 38.6 in., a width of 18.97 in. and a height of 36.06 in. The bearer-centres are 22.16 in. apart. The engine has a dry weight of 300 lb. and normally develops 105 b.h.p. at 1,900 r.p.m. The maximum output is 117.5 b.h.p. at 2,200 r.p.m. The fuel consumption is (*Continued on page 77*)



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/– should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

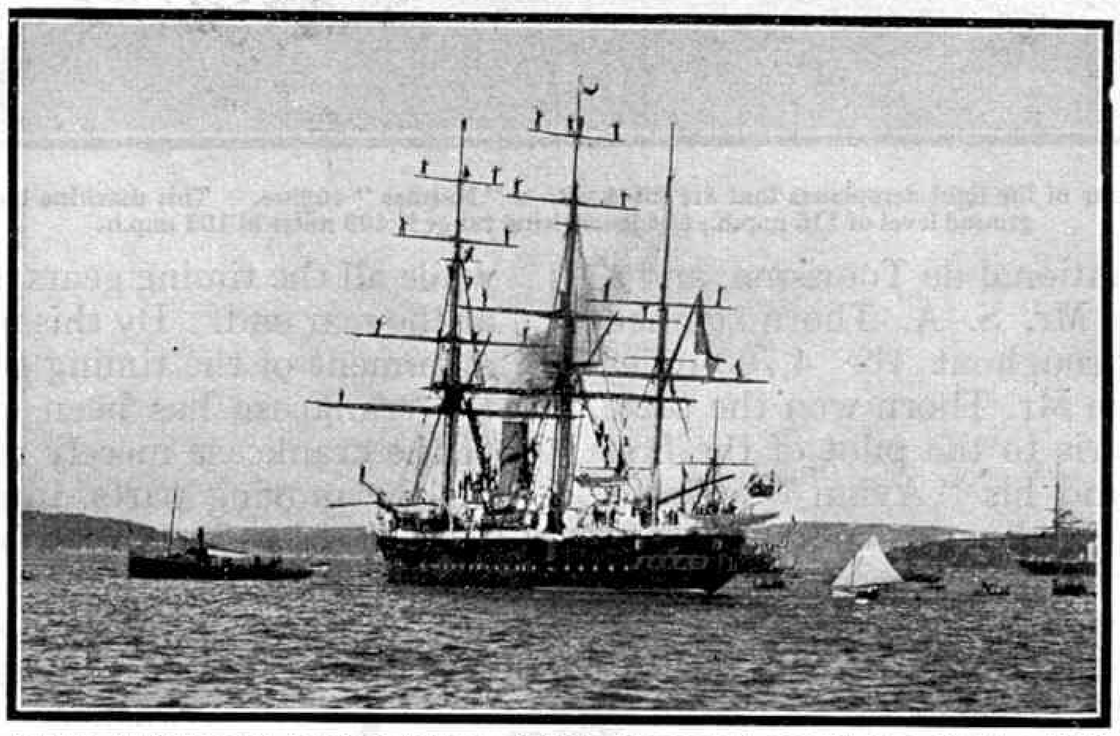
"Sea Escapes and Adventures"

By "TAFFRAIL"
(Philip Allan & Co. 5/–)

This is a remarkable record of adventures beginning with a true and gruesome story of cannibalism in 1765, and ending with the narrow escape of Hawker and Grieve while attempting to fly the Atlantic in 1919. Included in the book are the stories of Sir Ernest Shackleton's escape from the "*Endurance*" in the Weddell Sea; an account of the adventures of the whaleship "*Diara*" in the Arctic ice; Captain Scott's escape in the "*Terra Nova*" from an Antarctic hurricane; and other similar adventures.

One of the stories deals with the escape of H.M.S. "*Calliope*" (an illustration of her is shown on this page) from a great hurricane at Samoa. In March 1889 a squadron of men-of-war lay in the harbour of Apia, Samoa. The political situation had been very strained and the "*Calliope*," a corvette of 2,700 tons, was watching British interests. On the 15th March the barometer fell persistently, showing the coming of unusually bad weather, and the "*Calliope*" raised steam and struck her top masts in preparation for the coming gale. Shortly after midnight when a full gale was blowing and a fierce sea running, two ships in the harbour crashed into each other, whilst two others were adrift with their anchors dragging. By five o'clock in the morning a hurricane was raging and when dawn broke the officers of the "*Calliope*" were horrified to see the reef with its fringe of leaping breakers only 50 yards astern! Terrible seas were washing over the ship's bows and rising half way up the foremast. The other ships in the harbour were also in difficulties, some of them had sunk, the crews being drowned. In the end the "*Calliope*" managed to clear the entrance to the harbour and make good her escape, but only after a wonderful display of good seamanship under conditions of dire peril.

The book is illustrated with 15 half tone plates and five maps, which add considerably to the interest of the stories.



H.M.S. "Calliope" leaving Sydney, N.S.W., homeward bound 2nd October, 1889. (From "Sea Escapes and Adventures" reviewed on this page).

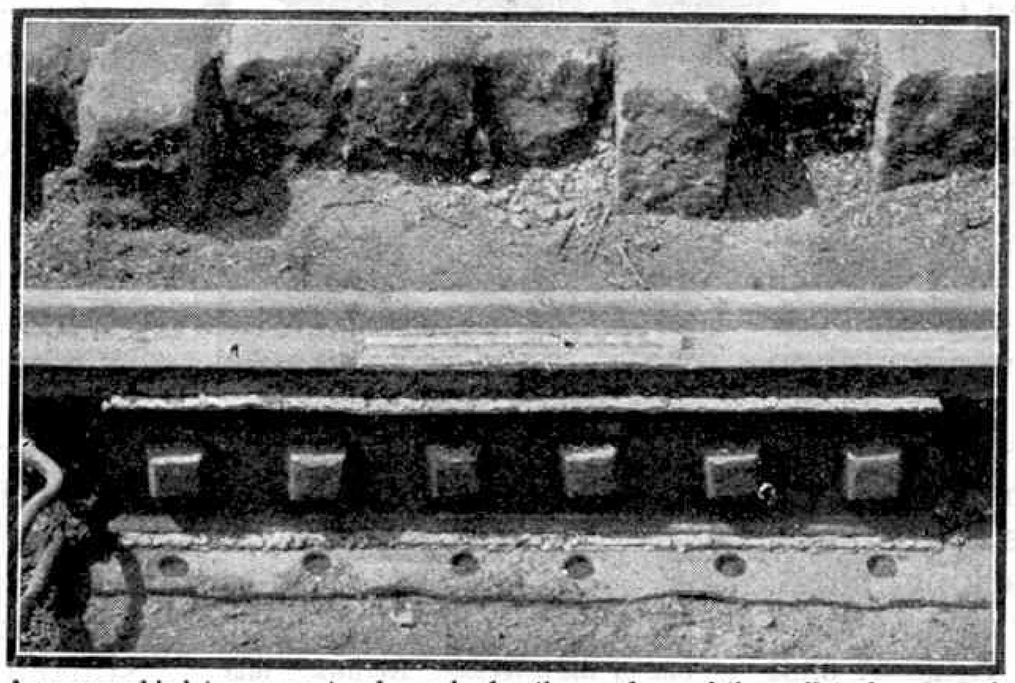
"The Boy Electrician"

By MORGAN & SIMS (Harrop 7/6)

Every reader of the "*M.M.*" who experiments with electricity and electrical apparatus will find this a book of great interest. Not only does it deal with this wonderful agent of mankind in a manner that can be readily understood, but it also describes many experiments in which the reader may "do something." In many of the existing books on electricity the experiments described are too complicated to be performed except in a fully equipped laboratory, and the apparatus required is generally too expensive to come within the reader's reach. In the present book, however, all the experiments have been carried out and the apparatus constructed by boys whose problems and questions have been studied and the results recorded. The apparatus used requires very little in the way of special material or tools, and our readers will find that they can use their Meccano Outfits to good advantage in several of the experiments.

The present is the fourth edition of this book and it has been entirely re-written and supplied with many new illustrations. Much interest is added by indicating from time to time the use to which electrical apparatus has developed in industry, transport, medicine and horticulture and—last but not least—in the home.

After dealing with magnets, static electricity, cells and batteries, and the units of electrical measurements, there are chapters on the arrangement of circuits, wires and cables, bells, telegraphs and telephones, induction coils, transmission systems, transformers, generators, and motors. The four final chapters are concerned with radio, electric railways, miniature lighting and miscellaneous electrical experiments. The book is illustrated with several half tone plates and a large number of line drawings in the text and is one that can be recommended with confidence to those interested in practical electricity.



An arc-welded tramway track ready for the surface of the rail to be ground. This photograph and the lower one on the next page are by permission of the Metropolitan Vickers Electric Co. Ltd., and are from "The Boy Electrician" reviewed on this page.

"The Raleigh Handbook"

By MENTOR
(Pitman & Sons Ltd. 2/– net)

This book is one of a series forming the "Motor Cyclist's Library," each volume of which is intended to be a complete guide to one particular make of machine. In this case the products of the Raleigh Cycle Co. Ltd. are dealt with. The author explains as simply as possible how each component part of a motor cycle works, and shows the rider how to become a safe and efficient rider. Special reference is, of course, made throughout to Raleigh machines, but the book also contains hints on management and adjustments and repairs that will be useful to every owner of a motor cycle. Special chapters are devoted to building, speed work and trial riding, and a particularly valuable feature is a section in which motor cycling terms are explained briefly but accurately. The illustrations include a number of interesting photographs and many helpful diagrams that will enable readers to follow without difficulty the interesting explanations given.

"Master Minds of Modern Science"

By BRIDGES and TILTMAN. (Harrap. 7/6)

Everyone is interested to read of modern scientific achievements, whether they be mechanical inventions or discoveries in other walks of life. From this book, which is published with the authority and consent of many of the distinguished scientists whose achievements it relates, we learn much about the wonderful discoveries of recent times, and also about the men who have made these discoveries possible.

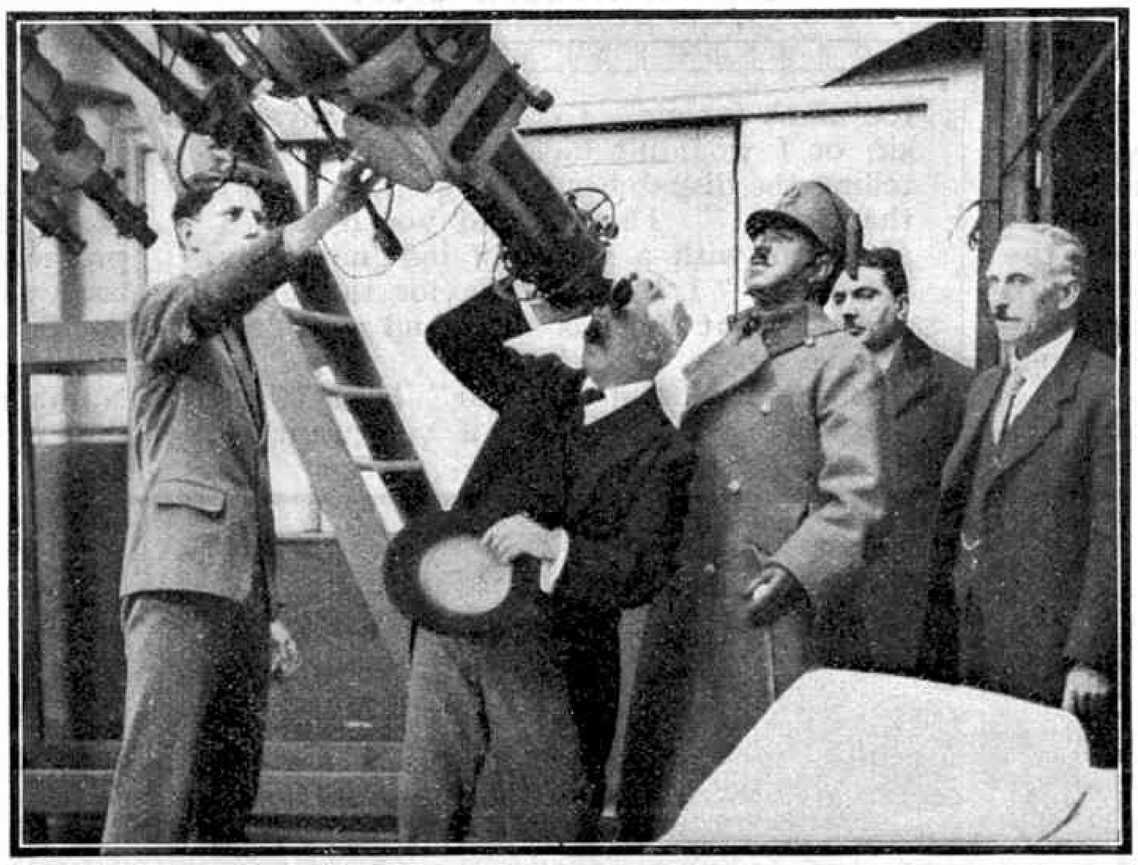
Commencing with the story of J. L. Baird, the pioneer of television, we pass on to such "master minds" as Sir Jagadis Bose, who discovered that plants and metals feel, just as animals and human beings do; Sir William Bragg and his X-ray experiments in the investigation of matter; Luther Burbank, the Californian plant wizard; the Curies and their discovery of radium; Professor J. B. S. Haldane and his experiments in bio-chemistry; Sir Charles Parsons and the turbine; Sir Ronald Ross on the conquest of malaria; and Sir Arthur Woodward and the remote past. All these fascinating discoveries, and others too, are dealt with in these pages.

One of the stories that we have not mentioned above is that of Sir Frank Dyson, the Astronomer Royal, and in it we are told about Greenwich Observatory, where for many years very valuable work has been carried out. Contrary to what some might expect, this work has not consisted of discovering new stars or searching the night sky (for the professional astronomer is seldom thus employed) but has to do with navigation, which entirely depends on the work done at our observatories.

The great problem before every ship's captain when he is out of sight of land, is to know where he is. Up to some 200 years ago it was easy enough for a sailor to discover his latitude by observation of the sun at midday or the Pole star at night, but to ascertain his longitude was a very different matter. (Longitude, of course, is the difference between the local time of the place where the observer is, and the local time of the place chosen as the standard meridian, which is Greenwich). What was so essential was the means of carrying Greenwich time on board ship—the necessity for a time-recording device that did not fluctuate with the heat of the equator or the cold of the polar regions. The difficulty was solved by the invention of the chronometer by John Harrison, who was born in 1693. To-day every ship carries a chronometer, which is corrected by broadcast time signals, so giving a greater accuracy than was possible before the invention of wireless.

It is the business of modern astronomers to be able to send out "Greenwich time," which sets the standard not only for Britain but for the world. This is done by taking regular observations of the stars to check a wonderful clock at Greenwich, which, by a marvellous mechanical device, corrects itself should it err even to the two hundredth part of a second! A second clock in the same room automatically sends the time signals to the great radio station at Rugby, from which they are broadcast to all parts of the Empire and received by navigators on every sea. This is a wonderful advance on the days when sailors depended on chronometers that were not always sufficiently accurate.

The book is a fascinating volume that will interest all "*M.M.*" readers, and it is made more interesting by the inclusion of 32 portraits of the men whose master minds have advanced modern science.



Sir Frank Dyson, Astronomer Royal, at one of the great telescopes of Greenwich Observatory demonstrating to Ex-King Amanullah. (From "Master Minds of Modern Science" reviewed on this page.)

"The Three Midshipmen" by W. H. G. KINGSTON. **"The Heroes"** by CHARLES KINGSLEY. **"The Fifth Form at St. Dominic's"** by TALBOT BAINES REED. **"The Further Adventures of Robinson Crusoe"** by DANIEL DEFOE (R.T.S. 2/6 each net)

When one considers the enormous change in the outlook of the average boy that has taken place during recent years, it is remarkable how many of the old stories still maintain their popularity. Kingsley's "*The Heroes,*" or Greek fairy tales for children, is of course a classic and will always be read; and the same applies in some degree to "*The Further Adventures of Robinson Crusoe.*" "*The Fifth Form at St. Dominic's*" survives, in spite of being hopelessly out of date in many respects, by reason of its truth to life. One feels that the boys in this story are speaking and acting perfectly naturally; in other words they are alive, and not merely dummies manipulated by the author. The same thing applies in a different way to the boys in "*The Three Midshipmen.*" In glancing through this book once more after an interval of many years one is struck with the amount of labour and care that must have been spent in writing it—a great contrast to the slip-shod, careless writing that characterises many recent books for boys.

An arc welder at work on tramway track. This illustration is from "The Boy Electrician" reviewed on the previous page.

"A Book of Marionette Plays"

By ANNE STODDARD and TONY SARG (George Allan & Unwin Ltd. 4/6 net)

It is remarkable how few people realise the fascination of making and playing with marionettes. We are all apt to regard it as rather childish until we try it for ourselves, and then almost invariably we fall under the spell! It is a hobby that we can thoroughly recommend to all our readers, for it provides wide scope for skill in designing and making the quaint figures, and ingenuity in bringing them to life, as it were. There are marionettes that consist of only a head and an empty costume, slipped upon the hand of the performer and manipulated by his thumb and fingers. The Punch and Judy show marionettes are of this type, and as we all know, they are extremely funny when cleverly handled. The true type of marionette, however, is operated from above by strings or wires, and its possibilities are practically endless. Even the simplest marionette production interests and amuses everybody if it is neatly carried out. Each of the small puppets seems to develop a personality of its own, and we follow its career with sympathetic interest. As regards real fun, there is probably nothing quite to equal the antics of well-designed animal puppets!

The "*Book of Marionette Plays*" provides a splendid introduction to this hobby. It contains five short plays specially written for puppet shows, in which the dialogue is simple and the action perfectly suited to the movements in which puppets are most successful. In addition the book contains clear directions for constructing puppets of various types, and tells how to make a complete marionette stage out of simple home materials. Finally there are practical hints for performing the various feats employed in the plays, and for lighting and general stage management. The book is illustrated by sketches of puppets of all kinds, showing how they are made and manipulated.

Interesting New Books

The undermentioned books, recently published, will be reviewed in a future issue.

"LAND OF SUN GOD" (Allen & Unwin. 12/6)

"FLIGHTS OF NAVAL GENIUS" *by* Brian Tunstall (Philip Allan. 12/6)

"ENGLISH SEAMEN AND THE COLONISATION OF AMERICA" *by* Kebel Chatterton (Arrowsmith. 12/6)

"ELECTRIC TESTING SIMPLIFIED" *by* H. H. U. Cross (Crosby Lockwood. 5/–)

"STUNT FLYING" *by* Capt. Richard Duncan (Crosby Lockwood. 7/6)

"SUDAN SAND" *by* Stella Court Treat (Harrap. 15/–)

"THE ATLANTIC" *by* Stanley Rogers (Harrap. 7/6)

Freckle Hogan's Grit

A Wild Race with Blazing Death

By A. Milton Kerr

CHIEF Dispatcher Manvell and Superintendent Burke were seated just inside the big arch of the room. Outside the arch was a large apartment with desks in the corners and along the walls, and in the centre tables covered with train sheets and telegraph instruments. The room was full of tobacco smoke and chattering Morse.

Presently Burke spoke, and his tone was harsh. "Then do you mean," he said, "that the fellow waiting outside is to get a position, although this letter says that he is unreliable?"

"Yes," said the Chief quietly. "It so happens that I knew a good deal about this chap in Chicago. He used to sell papers in front of the depot when I was fourth man in the dispatcher's office, there. One day I saw him pull a ragged little fellow out from under the feet of a wagon team. For a moment the two youngsters were mixed up with the legs of the horses; then the bigger boy rolled out of the tangle and pulled the little one with him. He looked at the sobbing youngster with vast displeasure; then gave him a fierce shake and said: 'You skip off home to your mother, you're not big enough to be out here mixing with *us men*!'

"It struck me that a boy who met emergencies in that way ought to make a good railroad man. I got him into the office as messenger boy, sent him to night-school and had him taught telegraphy. Afterwards he took a position as operator. Now I know him pretty well, and I don't believe that Jimmy is capable of deserting his post."

Burke rapped the desk sharply. "Tell that young fellow out there, Jimmy Hogan, to come in."

Hogan was ushered in. He appeared to be eighteen or nineteen years of age, was profusely freckled, slightly round-shouldered and small for his years. He had a keen alert expression and a fearless way of looking at people and things. His glance swept round the room and came to rest on Manvell's face. He said nothing, but his brown eyes and his freckles glowed.

"Well, Jimmy," said Manvell, "I have your letter asking for a job, but Mr. Burke here has a letter from Superintendent Taylor saying that you fell down on your last job."

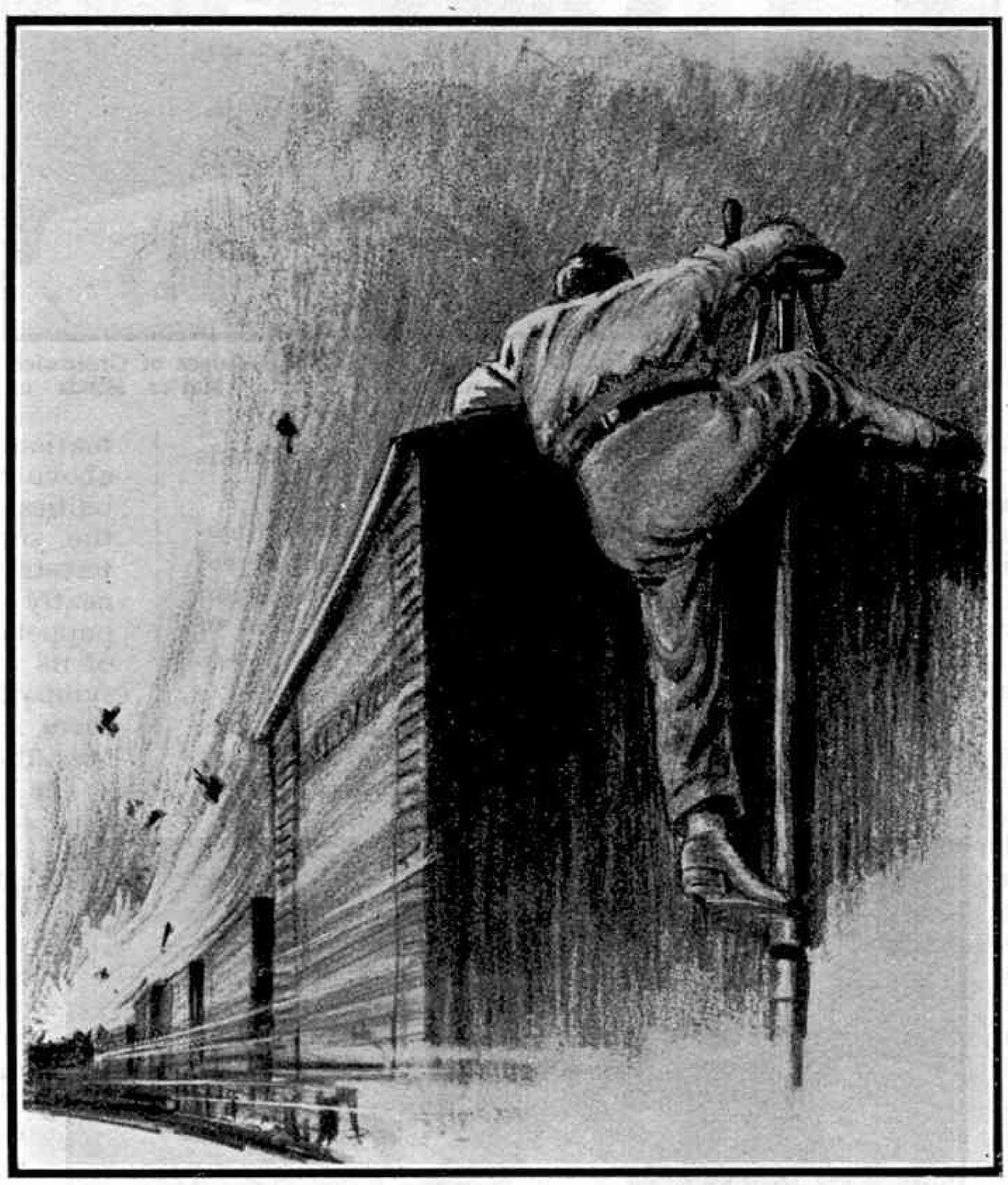
"Yes," said the Superintendent, drily. "How was it you left your tower one night in Chicago without giving the dispatcher notice, thus causing a wreck?"

"Some ruffians, four of 'em, sir, climbed into the signalbox and took me away by force, sir. I fought 'em, but they were too much for me. I couldn't help myself, sir, or I wouldn't have deserted without telling the dispatcher I was going; I ain't that kind!" The freckled youth looked at Burke with a gleam of indignation in his eyes. "I told Mr. Taylor that," he added, "but he was mad and wouldn't believe me."

Burke hesitated. "Well," he said to Manvell after a while, "if you want to send him out on the wire, all right; you'll be responsible, that's all."

Manvell smiled at Jimmy. "Come round in the morning," he said.

Within a week "Freckle" Hogan, as he quickly became nick-named, found himself telegraph operator in a little sheet-iron station on the Saddle Bow, away out on the West End. That was when the Western Central had been pushed clear across Colorado and a path for the steam-driven wheels was being blasted and torn through the Saddle Bow Range in Northern Arizona. Down that way nearly a thousand men were at work on construction, and Superintendent Burke made frequent visits to the scene of operations. Freckle's "office" was a movable affair, being at times folded up like a patent lunch-box and drawn on to a flat car to be transported to wherever an operator was most needed. Besides Freckle there were three other operators in lunch-box stations on the range, from eight to ten miles apart and progressing by occasional removals towards the west. There were two tunnels on the Saddle Bow stretch, Number 12, just west of Freckle's September station, and Number 13, eighteen miles farther down the western slope, piercing a towering mass of granite that blocked the way at the head of Bear Paw canyon. Late in August Number 12 was practically completed and the rails were laid down by many a twist and turn into the yawning bore of Number 13.



. . . . Struggling madly for the top of the car . . . .

On the last day of September, Superintendent Burke, and Fuller the Chief Engineer, went over the West End looking for weak places and stirring things up generally. They rode on various construction trains during the journey, dropping off here and there on errands of inspection. By sunset they were at Summit on the Saddle Bow range. There they boarded a train for Tunnel 13, where in the upper Bear Paw camp close by the tunnel's black mouth, they proposed to spend the night.

The train on which they took final passage for Tunnel 13 was a light one, consisting of nine flat cars of cedar ties, a box car, containing five tons of powder, and a caboose. The cars of ties were in front, the car with the explosive came next, then the caboose, and then Morgan with engine 382 pulling the train. This formation was well enough for climbing the eastern grades of the range, but in dropping down the western slope the engine should have been hooked on ahead in order to hold the train more effectively. As Burke boarded the train he roundly criticised Conductor Rawlins, who was in charge, for exercising bad judgment in this respect. Rawlins meekly pointed out that the train was not heavy and that he had always had the idea that it was good policy to keep an engine in the rear of powder so that sparks from the chimney might not blow back in its direction. Burke ridiculed the idea, but nevertheless it contained a grain of sense.

Several things having an influence on the ultimate situation happened within that hour. Frank McGuire, stationed in a lunch-box office near the mouth of Tunnel 13, had gone into the bore with a message for the foreman, and his arm had been broken by a falling rock. The plucky lad telegraphed the fact to Manvell with his left hand, and Manvell immediately called Freckle in his box near Tunnel 12.

" Flag Rawlins' special and go down to Number 13 and take charge until further orders," said the Chief. " McGuire has been injured. I will send a man out to Number 12 to-night to do your work."

" O.K.," replied Freckle, " I hear a train coming, expect this is it. I'll flag them and report to you from 13."

He scrambled up the caboose steps when the special stopped, and explained the situation.

" All right," said Burke. Then he looked again at Freckle. " Aren't you that Chicago boy, Manvell's pet ? " he asked abruptly.

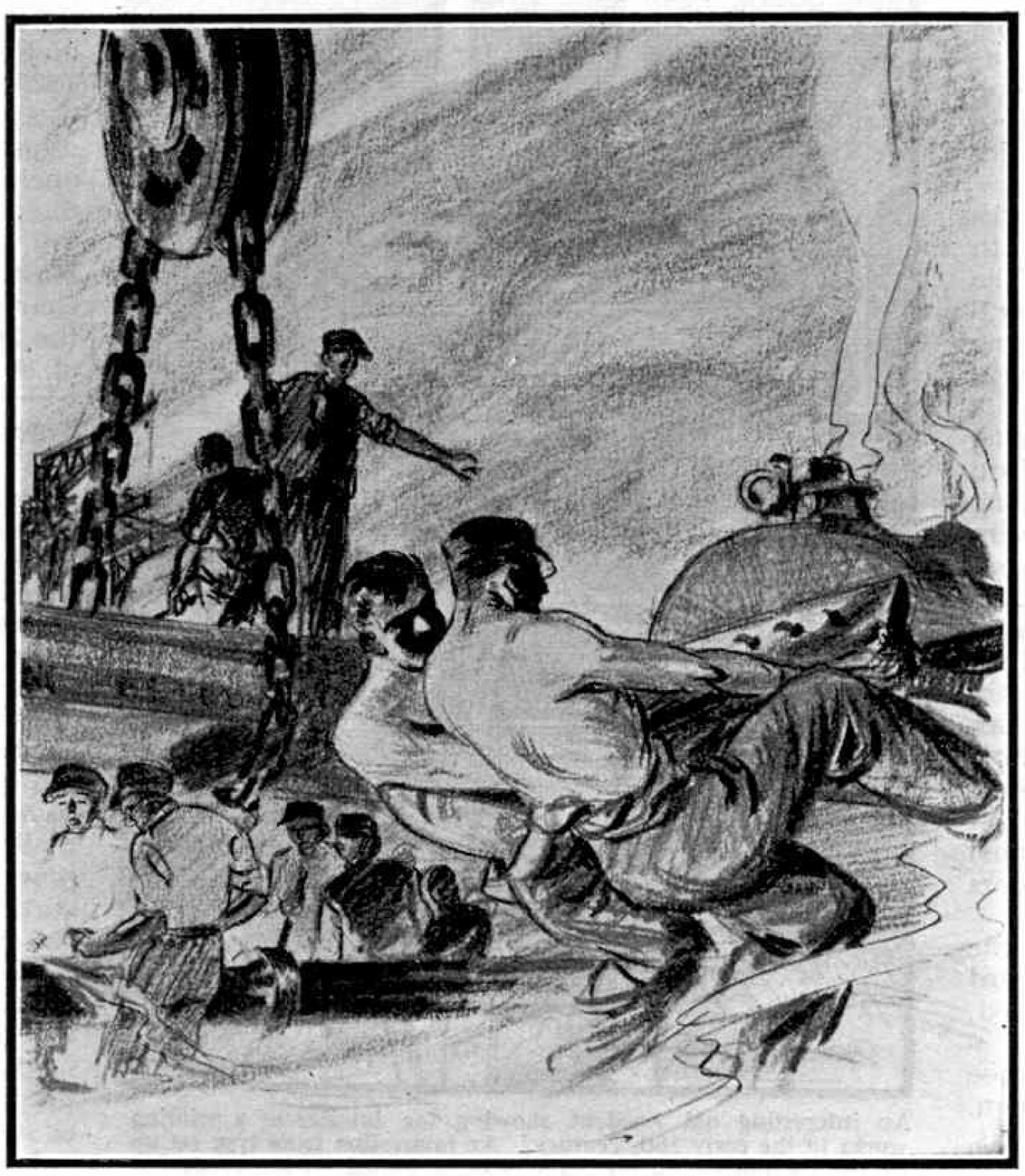
Freckle flushed. " Yes, sir," he replied quietly, and went out on to the front platform of the caboose where the rear brakeman was standing.

At that moment they entered Tunnel 12. Ahead of them stretched darkness, lightened here and there by lanterns hanging from rods of iron wedged into crevices of the rocky walls, for workmen were still chiselling at the rough spots of the ragged sides and ceiling. One of these lanterns, no doubt loosened from its support by the jar of the train, fell down unobserved among the dry ties of the foremost flat car, spilling its oil and flame among them. In three minutes' time tragedy lifted its wild face on the western slope of Saddle Bow Range.

No one noticed the fire until Morgan blew for brakes when the train had left the tunnel half-a-mile behind. Then the brakeman swung out to the left by the hand rods of the platform, and smoke and bits of burning bark blew into his face. Immediately he was seized with panic ; he dropped to the platform and seized the head of the pin in the coupling between the caboose and the powder car. " Head cars are on fire—powder—powder ! " he yelled, as he dragged frantically at the obstinate pin. At that moment Morgan, getting no brakes, put the reversing lever over ; the coupling clanked and the pin came out in the brakeman's hand.

Burke rushed forward, shouting hoarsely : " Put the pin back " ! but it was too late. The cars parted instantly, and as they did so Freckle Hogan leaped. He landed on the buffer beam of the powder car with his left hand clutching the brake-wheel rod that extended up the end of the car. Into his brain flashed an imaginary spectacle that for the moment swamped all fear—a picture of a train on fire hurling itself into the mouth of Tunnel 13, of a car of powder crumpling in a mass of bursting fire, of men and machinery, and all things flying into atoms.

Freckle began climbing up the brake-wheel rod, slipping back and climbing again, struggling madly to reach the top of the car with the one thought of setting the brakes and bringing the surging string of cars to a standstill. Vaguely he heard Burke's voice : " Set 'em, boy ! Get to the top ! Don't give up ! " Up Freckle struggled, following the slippery rod, flung to right and left and all but torn loose by the swaying of the car. A cloud of smoke streamed back over the top of the car, and into that stream those on the caboose saw him finally scramble. He lay for a moment, spent and choking on top of the car, then laid hold of the brake-wheel and set it with all his strength. The setting of the brake seemed not to have the slightest effect upon the flying train, but he knew that if he could set the brakes on three or four cars, these would hold the train. He clambered along the running board to the front end of the car and leaped down upon the next car, crept along to the forward end, and found the brake and twisted it hard. Struggling desperately against the strangling flood of heated smoke he crept forward again, but further progress was impossible. The forward three cars were a mass of leaping flame, and back over him the driving smoke streamed like some kind of awful hair tangled with a million fire-flies.



Men were working . . .

Freckle could breathe this awful smoke no longer. He struggled to the rear end of the car upon which he was, slipped down behind the heap of ties and covered his burning eyes. His head was filled with swirling thoughts. When would the car of powder explode ? How soon would the fire drive him from the train ? And the fiery wreck in Tunnel 13—what a vision !

Then in this awful turmoil of thought a whisper in Freckle's brain said : " Jump near the first Bear Paw bridge—at the track-walker's station—he has a box-relay on the wire there—telegraph 13 to get the men out of the tunnel—save lives—let the train go ! "

Freckle lay flat on the bottom of the car where there was a narrow space at the rear of the load. The sparks and hot smoke beat into his face ; the noise and lurching and twisting of the train appalled him. How far the train had gone he could only surmise but from the first Bear Paw bridge to Tunnel 13 the distance was about eight miles, that he knew. The heat increased, the smoke and sparks thickened, the cases of powder in the box car were leaping. Two and three and four minutes passed, year-long stretches of time, then he saw a crooked road of tumbling froth below him—the plunging train had struck the banks of the upper Bear Paw.

He drew himself farther over the edge, staring hard through the smoke. He must be near the first bridge now. Suddenly something seemed to shout in his ear " Jump " ! and he sprang at the white wavering thing below. Head-over-heels he fell, and the next instant he felt his right leg snap and a thrill of awful pain. Then he was in ice-cold water. Dimly he was conscious that the train of fire had gone roaring down Bear Paw canyon.

At many points between Tunnel 12 and Tunnel 13 men in camps along the half-completed line saw the terrible thing go in by the grey dusk, but they could do nothing. Burke, grim and pale, stood on the front platform of the flying caboose, now and then catching a glimpse of the blazing thing ahead. Morgan had the throttle open, but they could not get nearer than half-a-mile.

" Stop at the Walker's station by the bridge," Burke shouted to Rawlins. " If he's in we may catch 13 by the wire and get the men out of the tunnel." He glanced ahead and saw the flying wraith of smoke and flame wheeling downward through a bending grove toward the Bear Paw. And then he thought of that freckled boy from Chicago who was on the blazing train, trying to stop it !

With the tearing snarl of reversed drivers the engine jolted and stopped at the Walker's station. Fuller, Burke and Rawlins jumped from the caboose while the wheels were still turning, and dashed for the sheet-iron shed. Burke kicked the door open—the walker was not there ! The little box-relay on the table was rattling softly ; the men glanced at it and came out, for not one of them knew Morse. Burke looked up at the grey sky in which big stars were appearing, and his lips moved. Suddenly he saw something come crawling across the track in front of the caboose—a small figure that dragged itself forward on hands and knees. Burke leaped at it. " The boy—Hogan ! " he shouted, and gathered the bedraggled figure in his arms. " My leg's gone," faintly whispered Freckle. " Get me to the table quick, to the relay, so that I can call 13."

Burke literally ran with him into the station, placed him in the chair before the instrument, and steadied him with his hands. Freckle put out a shaking hand to the key, which went up and down. " Tc, tc, tc," it said.

Suddenly Burke remembered something. " Didn't you say that the tunnel operator had broken his arm ? He cannot answer ! "

" If Frank's in his bunk in the box," muttered Freckle through his teeth, " he'll answer if his neck's broken. He's Irish ! "

Freckle ticked out a full sentence : " If you're in your bunk, Frank, run to the tunnel and get the men out—runaway train on fire, car of powder at tail—if it doesn't blow up before it gets there it'll explode in the tunnel."

Get the men out!"

Then the current broke. "Who — says — that?" ticked the instrument falteringly.

"Freckle Hogan — first Bear Paw Bridge. That you Frank?"

"Yes."

"Get the night shift out — ".

"O.K."

"He's gone — after the — men — " murmured Freckle dreamily; then he rolled back in Burke's arms and darkness floated over him.

Almost at the same moment a young red-headed fellow with an arm in splints dashed out of the iron shed near the mouth of Tunnel 13.

"Get away from in front of the tunnel, get out of it," he yelled, as he dashed headlong into the bore. "Out of here every mother's son of you! Runaway train on fire — powder in train! Out of here!"

Sixty men came out of the works with the speed that terror of death alone can put into human legs. The head foreman was with them. "Scatter," he yelled, for the rails were whining and the canyon was roaring with echoes.

Then suddenly round a bulging point the fearful thing came into view, and the faces of the sheltering men turned still whiter. The ties were ablaze clear to the powdered car, and the forward end of that car was sheeted with fire and cinders and sparks were dropping down upon the cases. Into the tunnel rushed the flaming train with a seething roar—then came an appalling crash and the Saddle Bow range quivered to its foundations. Stones, twisted rails and broken machinery gushed from the tunnel mouth. There was a roar of boulders turning over—then silence.

As Burke gently laid Freckle on the seat cushions in the caboose he heard the detonation. "Rawlins," he shouted, "we'll run down to 13."

When they got down from the caboose near Tunnel 13 the foreman met them.

"Well?" said Burke in a curious, strained voice.

"No one hurt, but machinery and everything gone," replied the foreman.

"All right," said the Superintendent, with a long breath of relief. "Where is the Doctor?"

"Over there in the shed with McGuire."

"Get him, there's a boy with a broken leg here in the caboose. Fetch McGuire if he's able, I want to promote him."

Shortly afterwards Freckle went to the company's hospital at Paley Fork, and he went in a special car. One morning Burke and Manvell stepped into the accident ward; Freckle looked up from his cot, and his brown eyes glistened.

"Mr. Burke thinks we'd better make a place for you here at Headquarters," said Manvell, smilingly.

Freckle tugged nervously at the counterpane. "Don't know that I'm good enough; but if you think — "

"We'll manage that all right," laughed Burke. "You see, we're Irish"!

Famous Inventors—(*Continued from page 18*)

were connected by treadles operated alternately by the feet of the driver.

During the later years of his life he became interested in agriculture, and here again his love of mechanics found scope for expression. About 1793 he constructed a reaping machine, and 10 years later the Society of Arts awarded him a silver medal for a three-furrow plough that he had invented. With the exception of the rope-making machine and the grooved brick, Cartwright did not patent these various inventions, perhaps because he had found by experience that in those days a patent did not deter others from copying an invention.

When the patents for the power loom expired and the invention was no longer protected by law, the Lancashire mill-owners quickly adopted the loom. During

An interesting old woodcut, showing the interior of a printing works in the early 16th century. An impression from type set up by the compositor on the right is being pulled on the crude but powerful press, and on the left is a man with ink swabs waiting to ink the types.

1806 Cartwright was led to make enquiries as to the extent to which his invention was in use in the Manchester district, and he found that power-loom weaving was being done to a much greater extent than he had anticipated, and at considerable profit to the manufacturers. In a letter to a friend, an eminent physician in Manchester, Cartwright spoke bitterly of the unfairness to himself of the millowners' tactics. The letter aroused the sympathy of the doctor, and he communicated Cartwright's remarks to certain influential men in the city, who recommended that Parliament should be approached with a view to obtaining compensation for the inventor. They offered their aid in the matter, and in August 1807 a memorial on the subject, signed by 50 of the "most respectable and influential gentlemen of the town and neighbourhood," was presented to Parliament. This petition was backed up in the following year by a personal application from Cartwright, in which he stated his claim for recognition as the inventor of the power loom. The Government appointed a committee to investigate the matter, and it was revealed that he had spent between £30,000 and £40,000 in perfecting and promoting his inventions. Ultimately a grant of £10,000 was made to him in recognition of "the good service he had rendered the public by his invention of weaving."

The grant was sufficient to enable Cartwright to live in comfortable retirement, and he bought a small farm at Hollanden, between Sevenoaks and Tunbridge. There he spent the rest of his days carrying out various experiments in agriculture, mechanics and chemistry. At a time when there was an epidemic of banknote forgeries, he suggested a method of preventing them. On another occasion he submitted to the Royal Society a paper in which he expounded a new theory of the planetary system, "as far as relates to the power by which the planets are impelled round the sun." In July 1823, three months before his death, he was busy seeking a satisfactory means of using gunpowder in place of steam to operate the piston of working engines. Shortly afterward his health began to fail, and on 8th October he removed to Hastings. He did not benefit by the change of air, however, and he died on the 30th of the same month, at the age of 80.

Transport of the Future—(*Cont. from p. 11*)

Attempts have been made to do this without wires, but so far there seem to be serious difficulties in the way of wireless power transmission, the amount of power received at any one place being a very small fraction of that radiated. Some development of the beam system may solve such difficulties, or an entirely new method may be introduced; but in any case great modifications will be necessary in wireless apparatus if a really satisfactory proportion of the power developed at the generating station is to reach a distant point in this manner.

Wherever transmission of electricity by wire or any other means is possible, this method of power distribution will no doubt be adopted. But for aeroplane propulsion, and for ships, either surface or submarine, liquid air may prove to be valuable. It may be produced in compressors at the great power plants near the equator and stored under pressure in cylinders that are easily transportable.

This power medium may be used in two forms. In one it will be allowed to expand in some kind of turbine where, because of its enormous pressure, it will be far more effective than steam is at the present day. For an aeroplane, in which additional weight makes additional power necessary, machinery and propellers will be omitted altogether, the liquid air being allowed to expand through nozzles directed to the rear of the planes, to propel it forward like a rocket. This is by no means a visionary scheme, and suggestions for using liquid air in this manner have already been made. Its use is not feasible at present on account of its high cost.

The fantastic stories that we often read of the enormous power that will be obtained in future from the disintegration of atoms may be disregarded. It is quite true that the temperature of radium is higher than that of its surroundings, and that this remarkable source of heat continues to operate for incredibly long periods. A few tons of radium would thus be very valuable; but so far the total amount that has been extracted is only one pound, and there is no indication that any such quantity as a ton exists in the Earth within easy reach.

A World-Wide Fellowship of Boys

Why You Should Join the Meccano Guild

THE really happy boys throughout the world to-day are those who have a hobby in which they take an enthusiastic and lasting interest, and the happiest of all are Meccano boys, for their's is the greatest of all hobbies. When a boy takes up a hobby, whatever it may be, he feels a great desire to meet other boys having interests similar to his own, and to compare notes and talk things over with them. This is particularly the case with Meccano. No Meccano boy is content to "play a lone hand" for long. He very soon wants to meet other Meccano boys, to see their models and to show them his own, and to discuss plans and schemes for other and bigger models.

It is more than 20 years since Meccano began to take its place as the greatest of all hobbies, and even in those early days Meccano boys were forming themselves into little clubs and societies. Presently we at Meccano Headquarters began to receive letters asking us to set up some form of central organisation to which all the individual clubs and societies might look for guidance and which would weld them all into one great body. We realised that the desire for a central organisation was genuine and widespread and felt it our duty to do everything we could to satisfy this great demand.

A Unique Brotherhood

So the Meccano Guild, the most remarkable brotherhood of boys in the world, came into being in the year 1919, with Mr. Frank Hornby, the inventor of Meccano, as its President. The announcement of the birth of the Guild was received with the utmost enthusiasm throughout the great army of Meccano boys of all nations, and applications for membership began to come in immediately in large numbers.

To-day there is scarcely a civilised country in the world where members of the Guild cannot be found. More than 100,000 boys in every corner of the globe have undertaken to do their utmost to fulfil the chief aims of the Guild, and its constitution has caused it to be described as a "Junior League of Nations." With these boys enthusiasm for their common hobby acts as a bond of union, and there is no doubt that the effect of the spirit of friendliness and brotherhood, encouraged by the Guild on the actions of future generations, will go far towards justifying this description.

The Three Objects of the Meccano Guild

The three objects of the Guild, set forth in the form of application for membership, are as follows:—

(1) To make every boy's life brighter and happier.
(2) To foster clean mindedness, truthfulness, ambition and initiative in boys.
(3) To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

In order to join the Meccano Guild it is necessary for the form of application to be filled up, signed and witnessed. This form is then sent to the Secretary with a remittance to pay for a badge. The applicant is then duly enrolled as a member of the Guild and his badge and membership certificate are sent to him. The neat little triangular badge—its three corners representing the three objects of the Guild—and the handsome certificate are always received with enthusiasm. The price of the Guild badge is 7d., or 1/– if sent overseas.

World-Wide Distribution of Meccano Clubs

The Guild originated for the benefit of Meccano Clubs and to-day there are nearly 300 of these organisations. Their world-wide distribution is remarkable. Strong and flourishing clubs exist not only in Great Britain, but also in the great Dominions, such as Canada, Australia, and New Zealand, and the movement is particularly strong in the Union of South Africa. It is not confined to boys of British race living within the boundaries of the Empire, for in addition the youth of India and Singapore have been wholeheartedly welcomed into this world-wide brotherhood.

The Meccano Guild has spread northward to Iceland, eastward to China and Japan, and westward to the Pacific Coast of America. It recognises no international boundaries and the boys of other nations are as keen to unite in order to derive the greatest enjoyment from their hobby as are the boys of British nationality. Many affiliated clubs having large numbers of members exist in Egypt. In France and Belgium the Guild has been specially successful and in those countries a large number of clubs are firmly established. Italy, Switzerland and Spain add support to the movement. In Holland it is making great progress, and Guild literature is now printed in Dutch. The Guild also has obtained many recruits in Norway, Sweden and Denmark, where promising clubs have been established.

Across the Atlantic Ocean, the youth of the two Americas have learned to appreciate the spirit that animates the Guild, and it is here that in the immediate future the greatest advance may be looked for. Steadily but surely the Guild is making progress in the United States. Its aims and objects make a strong appeal to the boys of that country, and the energy and determination that they invariably display in the tasks upon which they enter probably will result in a wonderful increase in the number of active and flourishing Meccano clubs. In South America great progress also is being made, and it has become necessary to print all Guild literature in Spanish. How rapidly the Guild is gaining ground in South America, and also in Spain, is shown by the fact that a Spanish edition of the "*Meccano Magazine*"—the official organ of the Meccano Guild—is now published.

The organisers of the Guild have not overlooked the "lone" members. In many cases these live far away from the headquarters of a Meccano Club and often at a great distance from any other Meccano boy. For these members a Guild Correspondence Club has been formed. This places boys living in the remotest parts of the world in touch with others of similar interests.

The Meccano Guild is the common bond that unites more than 100,000 members. Nearly 300 strong Meccano Clubs have been founded in all parts of the world, and as the above portraits show, their Leaders and members are of many nationalities.

With the Secretary

"A Happy New Year!"

Once again I have the pleasure of wishing all members of the Meccano Guild a very bright and prosperous New Year. A very large number of them have already written to me to convey their good wishes for the coming year, and I have greatly enjoyed reading their cheery accounts of the splendid times they have had during the Christmas season. A spirit of cheerfulness also reigns in the clubs, in most of which very successful social evenings have been spent in company with interested friends who have the welfare of these organisations at heart, and there seems no reason why meetings during the new season should not be equally enjoyable.

In thinking over the events of 1930 I find that two things have been outstanding. One of these is the splendid increase in membership of the Guild, which constitutes a record. This result has been attained largely because of the increased activity of members, who have sought recruits with even greater energy than before. Nothing proves the success of an organisation better than the desire of members to pass on its benefits to their friends, and I hope that the personal efforts of members to extend the influence of the Meccano Guild will produce even more gratifying results during 1931.

The second outstanding feature of the past year has been the great improvement in the quality of the work of the clubs. My correspondence contains abundant proof that these have made wonderful advances; for instance, one Leader tells me that "each time we have a Visitor's Night, it is better than the previous one;" another writes that an excursion recently held was "by far the most successful ever undertaken;" and quite a number have written to tell me that in 1930 their clubs have made more progress than in any other year since their foundation.

It is also noteworthy that during the past year reports have been received from secretaries with greater regularity than ever, and with very few exceptions these are far more interesting than was the rule only a short time ago. Good reports from clubs are invariably reflected in greater keenness on the part of members, and I hope that during 1931 even greater use will be made of them.

One very satisfactory proof of the greater strength of Meccano Clubs is the growing tendency to give help to deserving causes. In many recent instances members have done excellent work on behalf of organisations intended to bring sunshine into the lives of less fortunate individuals. Actions of this kind are in the true spirit of the Guild, and during the coming year I hope to hear of many similar cases in which this spirit is shown.

Coming Events

Many interesting Exhibitions and displays of models organised by Meccano clubs are held at this time of the year, and I may remind officials that the appearance of a notice of an event of this kind in the "*M.M.*" will help to attract Meccano boys and others interested. As the Magazine goes to press considerably in advance of the date of publication, notice should be sent to me at least five weeks ahead, and should include full details of the time and place of the Exhibition.

The Newcastle M.C. is holding its second Annual Exhibition from 30th January, to 7th February, 1931. This event is being organised in conjunction with the Newcastle-on-Tyne Branch of the H.R.C. A wonderful array of working models is being prepared, and in addition demonstrations will be given almost continuously on an extensive model railway. The Exhibition will be opened at 6 p.m. on Friday, 30th January, by Alderman D. Adams, J.P., Lord Mayor of Newcastle. On Saturdays it will remain open from 10.0 a.m. to 9.30 p.m. and on other days the opening time will be 2.0 p.m. The charge for admission is 4d., and for children under 14 years of age 2d.

The Hendon M.C. is holding an Exhibition on 10th January, 1931. This will take place in the Town Hall, Hendon, and the opening ceremony will be at 3.0 p.m. The charge for admission is 6d. and children under 12 will be admitted at half-price.

Merit Medallions Awarded in 1930

BECCLES (Beccles Excelsior)—L. Cracknell, H. Oxborough, D. Stimpson, C. Kett. CORNWALL (Camborne)—G. Beckerleg, J. Rogers. DOVER (Pharos)—A. Dewar, S. Teasdale. EDINBURGH ("Twenty Eight")—W. Thomson, G. Whittington. EXETER—J. C. Blaker, N. Lee, R. Sprague, L. Watson, V. Watson, C. W. White. GLASGOW (Victoria)—J. Perrett, J. Thompson. GREAT BADDOW—H. Carter, P. Felton, D. Green, T. Richardson. HARROW (Locket Road)—J. Clacey, C. Clark. HARWICH—E. Bolton, J. Britton, R. Lovett, W. Mayes. HERNE BAY—J. Corbin. HESSLE—K. G. S. Kirk. HULL (Hull Grammar School)—F. G. Glew, G. King. (Newcomen)—H. Sundie. INNERLEITHEN (Pirn)—I. Angus, E. Dickson, P. Downes, J. Hardie. IPSWICH (Merelands)—V. Schlienger, E. Stroud. KNUTSFORD (Lecture Hall)—J. Leach. LEEDS: (Bramley)—D. Farrar, G. Mann. (Harehills)—T. Alderson, E. Barnes, J. W. Issott, K. Lancaster, W. Scott. (Horsforth)—M. Dickinson, J. K. Sutcliffe. LEICESTER (Belgrave)—K. Hatfield, S. Nown. LONDON: (Holy Trinity, Barnsbury)—A. Board, J. Bradford, L. Bull, J. Craggs, D. Hughes, W. Owen, V. Stevens, W. Watson. (Ken)—L. G. Butler, W. Charlton, S. H. Westlake, F. Witchell. (Roe Green)—D. Adie, K. Beniston, J. Knightley, L. Newton, F. Wilkes. MIDDLESBROUGH—A. Bradley, B. Crawford, J. Senior. NEWCASTLE-ON-TYNE—J. Armstrong, R. Drummond, J. Foster, J. Fraser, G. Gilbey, J. Graham, K. Taylor, S. Wilkinson. NOTTINGHAM (Attenborough Choir)—R. Albinson, S. Dodson, M. Head, T. Head, K. Orchard, G. Render. OXFORD (Headington Baptist)—Q. Hainge, G. Morris. PORTSMOUTH (Portsmouth & Southsea)—R. D. Sprigings. RUTHIN (Ruthin School)—K. E. Bark, H. D. Conby. SLIGO—J. Cunningham, T. Hanalan, J. Harvey, T. McLaughlin. SOMERSET (Wellington)—H. E. Bryant. SUNDERLAND (St. Columba's)—J. Brannagan, R. Hawdon, W. Henderson, G. W. Laws, A. Rodgers, G. Spain. SWINDON (Gorse Hill Baptist)—P. Culley, F. Draper, J. Titcombe. YORK—R. Senior.

OVERSEAS CLUB MEMBERS

AUSTRALIA (Hobart, Tasmania)—F. Downie, J. Hull, D. Hurburgh, C. Snook. DENMARK (Odin)—A. Thiele. FRANCE—D. Isambert, R. Isnard, P. Richard. GREECE (Athens College)—M. Altcheh, G. Hadjikiriakos. INDIA (Lahore)—J. Singh, R. Singh. ITALY—F. Andreani. NEW ZEALAND (Dunedin)—T. MacLachlan. SOUTH AFRICA: (Malvern Wesleyan)—I. Fisher, S. Hobson. (Observatory)—O. Papst, E. Philpott, G. Serrurier.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places, and boys interested should communicate with the promoters, whose names and addresses are given below:—

HOLLAND—A. Huidekoper, 40, Ruthardlaan, Bussum.
MOFFAT—Mr. S. Parry, Holm Park, Warriston.
NEW ZEALAND—Mr. F. Coates, 214, Cameron St. E., Ashburton, Canterbury.
NEW ZEALAND—L. Moore, Patea, New Zealand.
OXFORD—R. Lardner, 10, Howard Street.
REDCAR—K. Sotheran, "Brae Garth," Kirkleatham Lane.
WINDLESHAM—William E. Crow, 2, Pleasant View, Updown Hill.

CLUB NOTES

Orwell M.C.—Mr. J. Finlayson, Leader of the club, gave a lecture on "*Dredgers*," illustrating it by means of a Meccano model driven by an electric motor. Other talks were given by the Leader on "*Steam Engines*," "*Gear Ratios and Power Transmission*" and "*The Steam Shovel*." Each of these was followed by demonstrations of working models constructed by Mr. Finlayson. On Model-building Evenings members design and construct models illustrating special engineering features. A Hornby Railway section has been formed. Club roll: 24. *Secretary:* Miss E. D. Hepburn, Rutherburn, Milnathort.

Stonefield Parish Church (Blantyre) M.C.—A club model of a motor chassis has been completed. Members have also built a model railway and great fun is obtained by operating trains on it in accordance with a carefully thought-out timetable. One evening each month is devoted to games. Club roll: 10. *Secretary:* Robert Brown, 83, Merry's Rows, Blantyre, Lanarkshire.

Whitgift Grammar School M.C.—Many new members have been enrolled as a result of a vigorous recruiting campaign. An interesting visit was paid to the London Bridge Signal Box, where members were given instructions in the correct operation of a modern signalling system. Two lectures on "*The Panama Canal*" and "*The C.P.R. Route Across Canada*," and a paper on the "*Centenary of the L.M.S.R.*" were very enjoyable. Club roll; 26. *Secretary:* J. D. Mellor, 71, Birdhurst Rise, S. Croydon.

Borden Grammar School M.C. — Meetings are held in the manual workshop of the school. Most of them are devoted to Model-building, but Hornby Train Evenings also have been held and one evening interesting short talks were given by members. An Exhibition was held at the end of last session, at which Mr. W. J. Pullen judged the models and also gave an address on "*Motors as I have known them during the past 30 years*." Club roll: 24. *Secretary:* G. J. Dawkins, 27, Trotts Hall Gardens, Sittingbourne.

St. George's (Edinburgh) M.C.—An interesting feature of last session was a Runabout Night, when new members were made known to older ones, and engineering topics, the Club Library, and other interesting ideas were discussed by little groups of members. In a Model-building Competition the First Prize was awarded to the builder of a Combination Safe that could be sat on and thrown on the floor without being damaged. A model of a Two-seater Coupé won the Second Prize, and a large number of other splendid models also earned good marks. The Leader has bought a No. 6 Meccano Outfit and two Electric Motors for club use, and his kindness is greatly appreciated by members. Club roll: 68. *Secretary:* J. A. Gower, "Fairhaven," Russell Place, Trinity, Edinburgh.

Elm Road (Beckenham) M.C.—The club has been divided into Senior and Junior Sections in order to accommodate the new members. In a recent Model-building Competition entrants were required to build a Motor, a Crane, or a combination of the two, and it was noticed that the new members proved very successful. Hornby Train Evenings are held regularly. At one of these the track laid down was modelled on the L.B. & S.C. section of the Southern Railway. A Lantern Lecture on "*London's History and Romance*" was given, and Mr. W. D. Ross, Leader of the club, gave an interesting talk on "*The Practical Applications of Electricity*." Club roll: 29. *Secretary:* C. W. Price, 52, Queens Road, Beckenham.

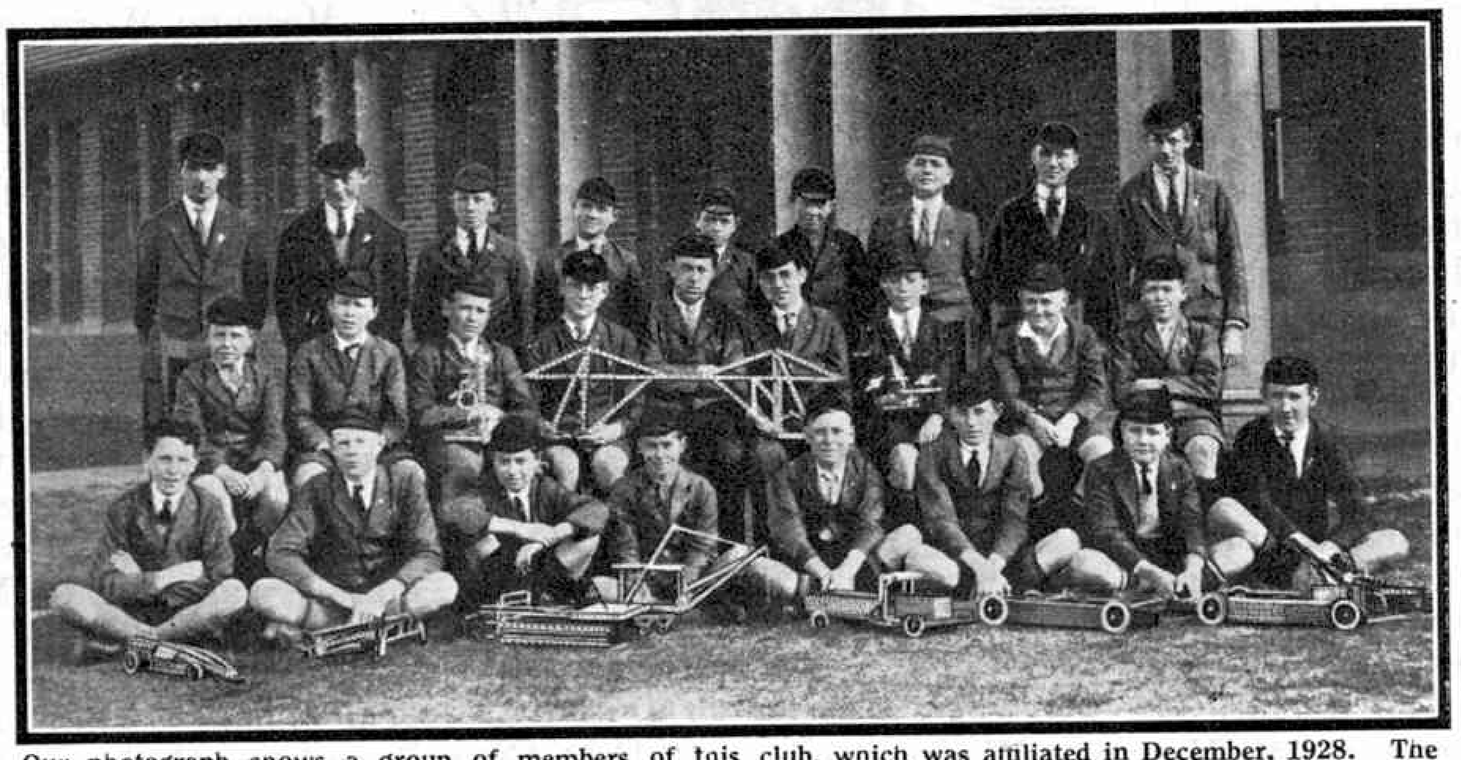
Newcomen M.C.—Competitions are held weekly, and a medal is to be presented to the member who gets most marks in these during the session. On Model-building Nights several interesting Cranes and Crane Trucks have been made. A Handicraft Night has been held, when articles for sale at the forthcoming Exhibition were made. On Members' Night two members entertained the club with tricks, jokes, short lectures and cross talk. Club roll: 10. *Secretary:* H. Acklam, 103, Newcomen Street, Hull.

Locket Road (Wealdstone) M.C.—A full account of the recent Railway Centenary Celebrations were given by Mr. Baker, who visited Liverpool in order to be present at them. This was illustrated by means of slides kindly loaned by the L.N.E.R. Several Hornby Railway evenings have been held. On these occasions members not possessing locomotives or rolling stock built models of vehicles for use on road or rail. Excellent models of semaphore signals were also made and successful experiments were carried out with them on the track. Club roll: 30. *Secretary:* T. Pantry, 4, Rusland Road, Wealdstone, Middlesex.

Churchill M.C.—The club has now developed into the maintenance and production department of the Churchill Eranch of the Hornby Railway Company, and wagons and other rolling stock have been built on mass production lines. Talks and practical trials on "*Bridge and Viaduct Building*" were given by the Leader, Mr. C. E. Blake. A large scale model of a "Royal Scot" locomotive is being assembled as a club model. Club roll: 18. *Secretary:* Mrs. C. E. Blake, School House, Churchill, Oxford.

The Leas (Hoylake) M.C.—Meccano Model-building is the chief attraction and the two Outfits owned by the club are in constant demand. Mr. J. F. G. Bigland, Leader of the club, has given interesting talks on Engineering subjects. At one meeting passages from "A Boy's Life of Sir Henry Segrave" were read. Several books have been added to the Library, which now contains many useful volumes. Club roll: 52. *Secretary:* J. M. C. Hughes, Leas School, Hoylake.

THEBARTON HIGH SCHOOL M.C.



Our photograph shows a group of members of this club, which was affiliated in December, 1928. The chief activities of members are model-building, in which competitions are frequently held, and discussions on scientific subjects. The Leader of the club, Mr. E. S. H. Gibson, is keenly interested in science and under his direction the members are becoming equally enthusiastic.

Hornsea M.C.—Members are now classed as "Engineers" and "Apprentices." New comers enter the second section and earn promotion to the first on passing a practical test. A special Lantern Lecture on the "*Telephone*" was given by Mr. R. W. Shooter, Leader of the club. Those present were shown how to make a Graham Bell Telephone, and several members made examples at home. Other Lantern Lectures have been given by the Leader on "*Steam Turbines*" and "*Norway*." At an Engineers' Meeting short lectures were given by members, these being illustrated by slides chosen and arranged by the lecturers. The best of these were determined by vote. Club roll: 14. *Secretary:* P. Thom, 5, Alexandra Road, Hornsea.

South Park Central M.C.—Last session opened with a successful business meeting and was followed by Model-building Evenings and Competitions, a particularly interesting model constructed being a Mechanical Cross Bow. A special Competition was open to Fretwork enthusiasts as well as Meccano Model-builders. An interesting Debate was held on "*Airships v. Aeroplanes*," when aeroplanes were voted the more reliable. Club roll: 32. *Secretary:* R. Merchant, 37, Montreal Road, Ilford, Essex.

Wallingford County Grammar School M.C.—Mr. G. Clarke, B.A., has resigned the Leadership, having left the district, and Mr. T. L. Pasquill, B.A., has kindly taken his place. An excellent programme has been arranged in which are included interesting Model-building Competitions. A Debate has been held on the motion "*That Airships are a Practicable Proposition*." This was lost by a large majority. Club roll: 19. *Secretary:* C. W. Turner, The Manse, St. Mary's Street, Wallingford, Berks.

Sutton Bridge M.C.—Mr. G. Hannant has kindly accepted the post of Leader, and an excellent programme of Model-building Evenings and other attractive features has been arranged. Group Model-building is carried out, "Seniors" and "Juniors" building large models of a Warehouse and an Aeroplane respectively. These have been displayed in a local shop window. Club roll: 12. *Secretary:* F. E. Scales, 18, Wharf Street, Sutton Bridge.

Whitstable M.C.—In a recent Model-building competition entrants were required to build representations of buses employed on local services. Many excellent models were produced and small prizes were given to the two members whose models were judged the best. A debate on "*Meccano v. Hornby Trains as Hobbies*" has been held. An interesting contest was a painting competition, in which members were asked to colour a Meccanograph design, and attractive competitions in track work on the club's Hornby Train layout have been held. One that attracted special interest was a Shunting Competition. Club roll: 20. *Secretary:* L. Dale, 77, Albert Street, Whitstable, Kent.

Portsmouth and Southsea M.C.—An interesting programme has been arranged by this newly constituted club. Interesting lectures have been given on "*A Six-Wheel Drive Tractor*," by Mr. F. E. Paul, and the "*Coal Mines of Wales*," by Mr. W. H. Morton Davies, Leader of the club. On Model-building Evenings interesting productions have been representations of a Dirt Track Motor Cycle, a De Havilland "Puss Moth" and a Ship Coaler. Club roll: 18. *Secretary:* J. S. Kent, 57, Kirby Road, North End, Portsmouth.

1st Rhyl M.C.—In the latest Model-building competition the first prize was won by a model of "*R.101*." Other models entered included Seaplanes, Boats and Motor Cars. Interesting general knowledge tests are arranged from time to time. Recent competitions of this kind have been on railways and political affairs, and others have involved knowledge of speed records on land and sea. Meetings have been held jointly with the local branch of the H.R.C. and competitions and excursions in which members of both organisations may take part are arranged. Club roll: 15. *Secretary:* Alan Day, Aled Cottage, Wellington Road, Rhyl.

"Twenty-Eight" (Edinburgh) M.C.—A particularly interesting visit was paid to the L.N.E.R. Locomotive Depot at Haymarket, where a number of "Pacifics" and other well-known types of locomotives were seen. On Model-building Evenings, which form the majority of the meetings, members are this season selecting for themselves the models they build and are showing great keenness. Model Aeroplanes are attracting attention and a comprehensive address on this subject has been given by Mr. T. Kerr. Club roll: 19. *Leader:* Mr. Jas. M. Ferguson, 7, Roseneath Terrace, Edinburgh.

Gaywood M.C.—Among interesting models made at recent meetings have been excellent Racing Cars and Aeroplanes. A large number of models for exhibition in a Miniature Fair have been constructed and great interest has been shown by members in Contractors' Evenings. Exciting Model-building Competitions also have been held. Club roll: 8. *Secretary:* C. N. Jones, "Gaywood," Solihull.

Victoria (Glasgow) M.C.—A lecture on "*Bridges*" was recently given by the Leader, Mr. H. Thompson, who illustrated it by means of slides made by himself. Joint meetings with Morison Memorial M.C. continue. Club roll: 26. *Secretary:* Robert Hannah, 52, Thornwood Avenue, Glasgow, W.1.

Australia

Hobart (Tasmania) M.C.—A successful supper was held on Anniversary Night, when cakes, etc. were contributed by members. The Annual Exhibition held in October was well advertised by a display of models in the windows of Meccano dealers, and also by announcements shown on the screen of a Picture House and broadcast from two wireless stations. The Mayor of Hobart opened the Exhibition. This was a wonderful success and the sum of £8 was raised. Sir Henry Segrave's car, "*The Golden Arrow*," visited Hobart, and the club exhibited models at the show where the record breaker was on view. Club roll: 21. *Leader:* Mr. S. G. Green, 13, Wilmot Street, Hobart.

Thebarton Technical High School M.C.—A special "*M.M.*" evening was held, copies of the Magazine being distributed among members. In recent Model-building Competitions entrants have been asked to construct models of Bridges and "Simplicity" models. A Competition that proved particularly popular was one for an optional model. A demonstration on "*Liquid Air*" was given by the Leader. Liquid air was kindly supplied free by the Western Oxygen Co. Ltd., and nearly £2 was raised in admission fees. A portion of the proceeds were given to the School Gymnasium Fund. Club roll: 27. *Secretary:* A. Haegi, T.T. H.S., Ashley St., Thebarton.

2½ Million to 1 Gear Ratio

Turn the Handle for a Month and Driven Shaft will Revolve Once!

By "Spanner"

IF I had been asked to design a gear box measuring 2½ ins. wide, 2½ ins. long, and 1½ ins. deep, to give a difference in speed between the driving and driven shafts of 2½ million revolutions, I would have declared the task utterly impossible. Yet I have just seen a gear box that complies with these conditions—at least, to be absolutely correct, it gives a ratio of 2,476,099 to 1! And—what is still more astounding—it is constructed entirely from standard Meccano parts.

Mr. Hornby showed me the model and explained its operation. Pointing to the small handle on the driving shaft, he told me that if I turned this handle at 60 revolutions per minute night and day without losing a moment of the 24 hours, I should succeed in making the driven shaft complete one revolution after 28 days 15¾ hours. But I did not accept his offer to test the truth of this, for I felt that long before the driven shaft completed a tenth part of its revolution, I should be winding imaginary handles in a padded cell!

The gear box is illustrated on this page and as will be seen it consists merely of an arrangement of Meccano Worms and Pinions. Before proceeding any further I had better give a list of the parts of which it is composed, in case some keen Meccano boy wishes to build it and test the accuracy of the above figures without delay. The list includes the parts necessary to construct the mechanism and also the framework and supports as shown in the illustration :—

2 of No. 3 ; 4 of No. 5 ; 4 of No. 9f ; 2 of No. 15a ; 3 of No. 16 ; 1 of No. 17 ; 5 of No. 26 ; 5 of No. 32 ; 18 of No. 37 ; 1 of No. 45 ; 1 of No. 48a ; 1 of No. 48b ; 9 of No. 59 ; 1 of No. 62 ; 1 of No. 115.

The Rod 1 is only 2 ins. long. In addition to the handle it carries a Worm 2, and its inner end, protruding about ¼ in. from the Worm, is inserted in the centre bore of a ½ in. Pinion secured to the driven Rod 3, a Washer being placed between the Worm and the Pinion. The Rod 3 is journalled in the 2½ in. × ½ in. Double Angle Strip 4 and in a Double Bent Strip bolted to the Strip 4. The Worm 2 engages with a ½ in. Pinion secured to Rod 5, which carries another Worm 6 meshing with another ½ in. Pinion on a Rod 7. Rod 7 carries a third Worm that, in turn, engages with the ½ in. Pinion 8 on the Rod of the fourth Worm 9. This Worm engages with yet another Pinion that is secured to the Rod 10, and a Worm 11 on the latter drives the Pinion (already mentioned) on the driven Rod 3.

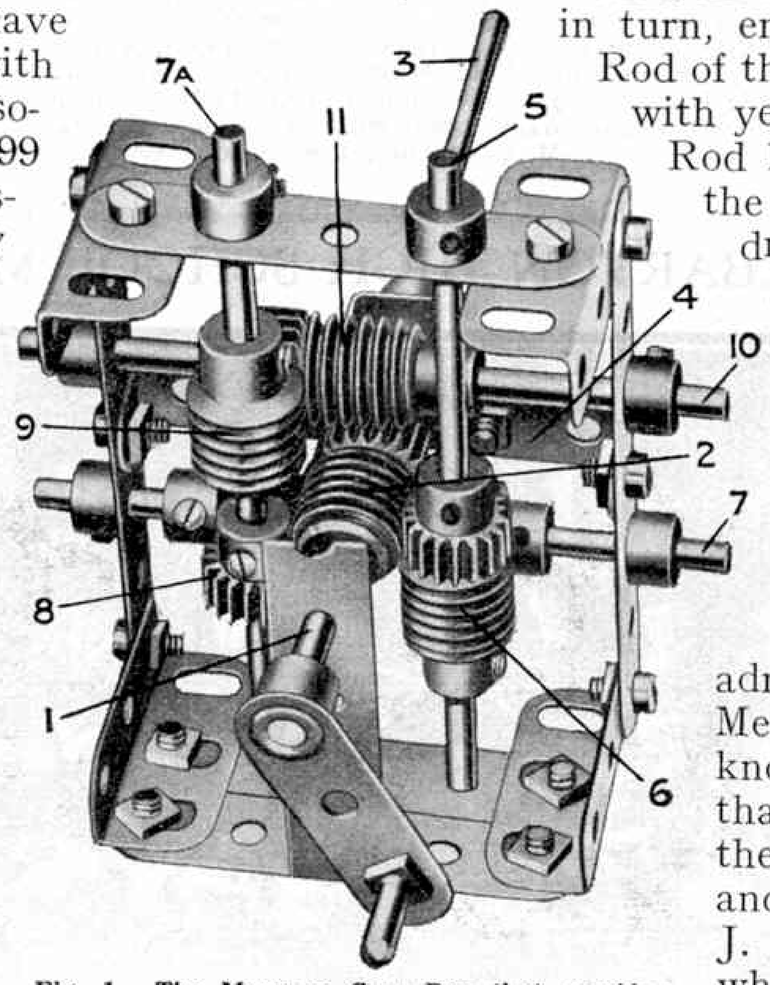


Fig. 1. The Meccano Gear Box that provides the amazing speed ratio of nearly 2½ millions to 1.

As every Meccano boy knows, a single Meccano Worm engaging with a ½ in. Pinion (19-teeth) provides a speed ratio of 19 : 1, and since this gear is repeated five times, a simple multiplication sum will show any Meccano boy that the gear box illustrated affords a ratio of 2,476,099 to 1.

After a few moments spent in silent admiration of this truly marvellous Meccano mechanism, I naturally wanted to know the history of the model. I learnt that it was constructed by Major Hatcher, the inventor of this type of gear box, and it was sent to Meccano Limited by J. Stone and Co. Ltd., of Deptford, who specialise in the manufacture of such gear boxes. They are known as the "H-R Gears" and are designed for all purposes and are obtainable in numerous different sizes.

The H-R gear is the smallest speed reducer for a given output in the world. "*M.M.*" readers will have no difficulty in believing this statement after examining the Meccano model ; indeed I think the model should convince anyone, from the least mechanically-minded to the skilled engineer, of the value and adaptability of the actual device. As a comparison with the Meccano model, Fig. 4 shows an actual H-R gear box capable of providing a reduction of 10,000 to 1. The gears are of the worm type and the principles involved are similar to those in the Meccano model.

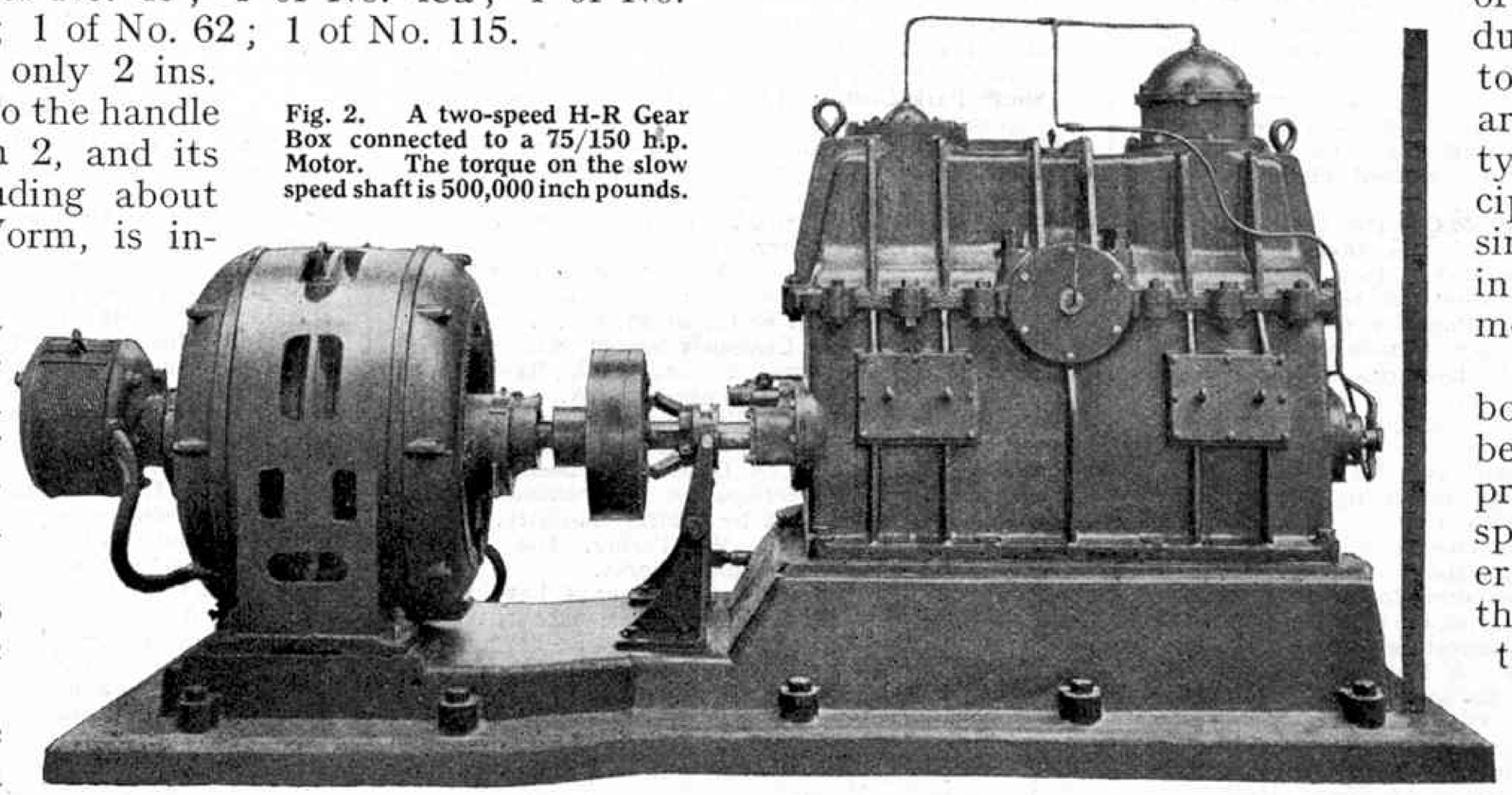
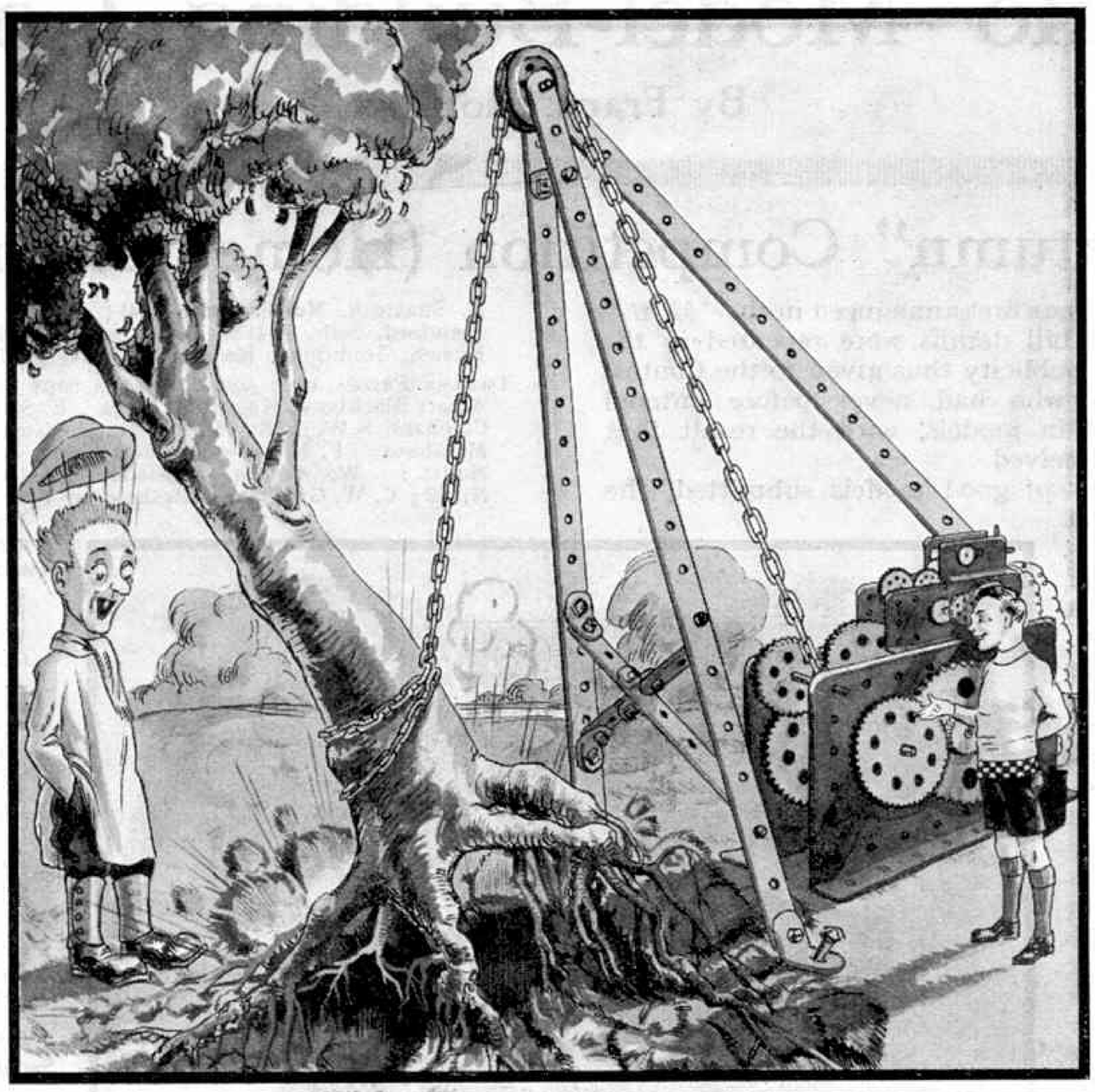


Fig. 2. A two-speed H-R Gear Box connected to a 75/150 h.p. Motor. The torque on the slow speed shaft is 500,000 inch pounds.

The H-R gear box can, of course, be designed to provide various speed ratios greater or smaller than the example illustrated, and it may be applied with advantage in all cases of

engineering work calling for the use of a reduction or increase in gear. In spur gearing the speed ratio is dependent upon the pitch diameter of the wheels, so that for large ratios several trains of gears are necessary, involving great expense and occupying an amount of space that increases in proportion to the extent of the ratio obtained, or alternatively, wheels of very large diameter must be used. The design of the H-R gear is based on the fact that in worm gearing the speed ratio has no definite relation to the worm diameter, and as in the standard H-R gear a ratio to the third power (i.e. three separate stages in the reduction) is obtained, enormous ratios are possible.

One of the most important features of the gear is the placing of gear shafts around the periphery of the driving worm and the driven worm wheel, thus permitting the first and final shafts to be arranged co-axially (although, of course, H-R gears can be obtained if desired for transmitting the drive at right angles). Other advantages are the small number of working parts, and economy in lubricants due to the compact oil-tight design and low working pressure, which enable the gears to work continuously in an oil bath.



This is the result of our artist giving his imagination free play after reading " Spanner's " reference to the possibilities of gearing ! Theoretically, there is no reason why a Meccano Motor could not uproot a tree, provided that sufficient reduction gearing were employed, although in order to raise the tree, say, one foot, it would probably be necessary to run the Motor continuously for many years.

In these days, when every inch of factory space is of enormous value, the compactness and adaptability of the H-R gears is invaluable. They are used in many different types of machinery, such as lifting, conveying and hauling plants, bakers' ovens, mechanical stokers, theatre safety curtains, museum and shop-window models, cranes, and recording instruments, etc.

Meccano boys will be particularly interested to learn that H-R gear boxes are employed in the Meccano Factory. For example, several are used in operating drying frames, which take the form of slow-moving conveyors that carry the freshly enamelled Meccano or Hornby Train accessories on loosely-slung trays. The conveyors are led to and fro round numerous guide pulleys, so that they occupy as little space as possible, and the whole plant is enclosed in a warm, dust-proof room. One conveyor takes $8\frac{1}{2}$ hours to complete one circuit and when loaded weighs $4\frac{1}{2}$ tons; yet the Electric Motor that drives it is of little more than $\frac{1}{2}$ h.p. ! The H-R gear box in this case gives a reduction of 9,720 to 1 and is connected to the motor by a chain drive which provides a further step down in speed.

I do not know of any practical use that a $2\frac{1}{2}$ million to one ratio could be put in Meccano model-building, but the gear box is of great interest as a novelty and as a demonstration of the possibilities of worm gearing. Of course, it is not necessary to employ the whole of the gear train; the drive can be taken from any one of the intermediate transverse shafts 5, 7, 7a, and 10, when the ratios obtained would be 19; 361; 6,859; and 130,321 to 1, respectively. These ratios would be found very useful in Meccano engineering when extremely slow movements are required, or when it is necessary to overcome very great strains.

The power obtained by connecting a Meccano Electric Motor to the driving shaft 1 and employing the full reduction of $2\frac{1}{2}$ million to 1 would be truly enormous—far in excess of the maximum strain which the Meccano parts—or for that matter any other engineering parts of the same size—could be expected to withstand. Indeed, writing of such terrific ratios reminds me of the boast of Archimedes, the famous mathematician and scholar who flourished in the third century B.C., and who declared that, given a fixed point, he could lift the world by means of a simple lever. There is no doubt that whilst he illustrated his point in a highly imaginative way, his statement was perfectly correct in theory, and the same thing could be said, theoretically, of the Meccano Electric Motor. If it were possible to secure it to some point in space, and friction could be eliminated or reduced sufficiently, it could be used to raise the Earth, although I am not prepared to state the gear reduction that would be necessary, or the length of time occupied in carrying out the task! Even if I could state such details, I am certain the Editor would not agree to filling several "*M.M.*" pages with nothing but figures!

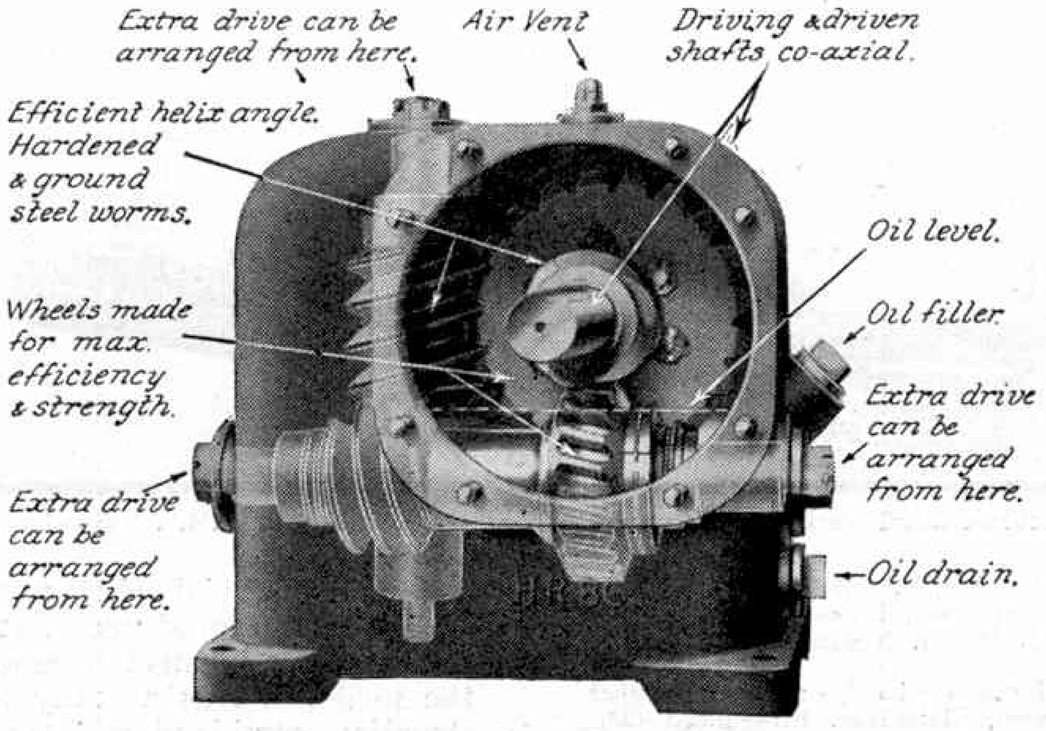


Fig. 4. The actual H-R Gear Box, on which the design of the Meccano Gear Box is based.

Results of
Meccano Model-Building Contests

By Frank Hornby

"Autumn" Competition (Home Sections)

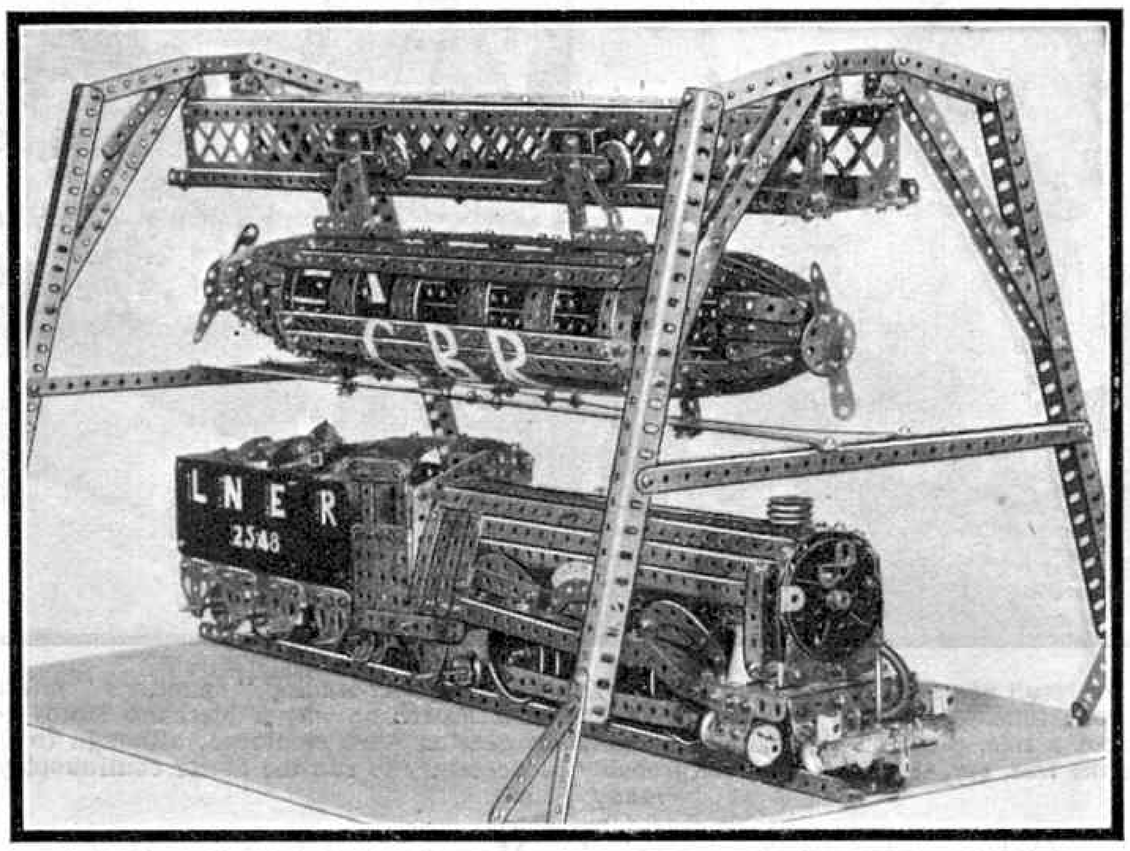
THE "Autumn" Competition was first announced in the "*M.M.*" for September 1930, and full details were repeated in the October issue. The wide publicity thus given to the Contest induced many model-builders who had never before entered Meccano competitions to send in models, with the result that a really splendid entry was received.

In view of the large number of good models submitted, the judges decided to award several prizes in addition to those originally announced; and even then many really praiseworthy models had to be left unrewarded. However, since it was impossible to reward all competitors, those who were not fortunate enough to carry off a prize on this occasion must not be disheartened, for if they will only persevere there is no reason why they should not find their names among lists of prize-winners in future contests. It must be emphasised that in this contest the standard of the entries generally was very much higher than the average.

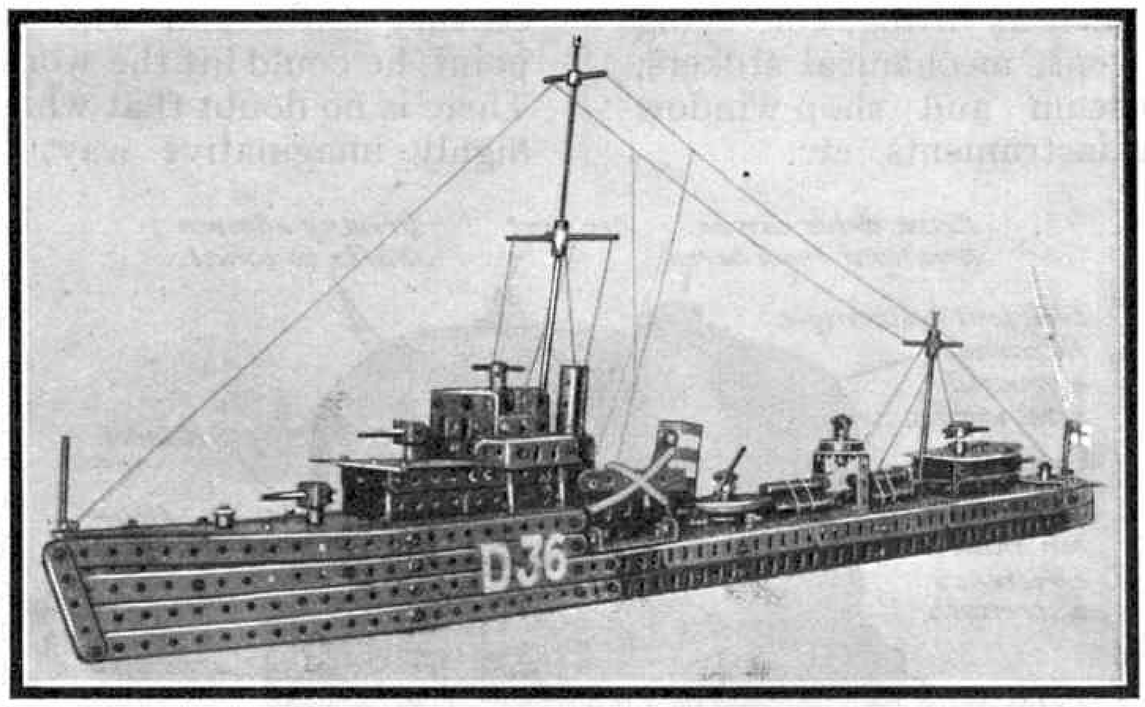
Special interest attached to the judging, for an entirely new system was adopted for the first time. Under this scheme points were allotted to each model under the following headings:—Meccano Construction, Originality, Realism, General Interest. In addition points were added to the total gained by each model, according to the competitors' age.

Six competitors gained the same total of points, and the first three prizes were therefore added together and the total value divided equally among the six competitors concerned. The Editor decided to make a special award to a competitor whose model gained one point only less than the six highest totals. The full lists of awards are given below, together with the total points obtained by each of the principal prize-winners.

In addition to the prizes mentioned in the following lists, about fifty Meccano Certificates of Merit have been awarded.



A model of the George Bennie Railplane and an L.N.E.R. "Pacific" Locomotive, constructed by R. C. Grant.



Accurate detail work is a prominent feature of this model of H.M.S. "Vivacious," by A. M. Messenger.

Section A (for competitors over 14 years of age).

The First, Second and Third Prizes have been combined and divided amongst the following six competitors, who will each receive a cheque to value £1-1s.: J. H. Beecroft, Radcliffe-on-Trent, Nottingham (40); Anthony M. Messenger, Rochester (40); R. W. Blake, St. Margarets-on-Thames, Twickenham (40); R. C. Grant, Aberdeen (40); F. S. Beard, Fishponds, Bristol (40); K. Garner, Bickenhill, Hampton-in-Arden (40).

Editor's Special Prize consisting of a cheque to value £1-1s. has been awarded to the following competitor: F. E. Paul, Basingstoke, Hants. (39).

Six Prizes, each consisting of Meccano products to value 10/6: Stanley R. Davidge, London, N.16 (38); Eric Campbell, Castledermot, Co. Kildare (38); L. A. Frayn, Stoke, Plymouth (38); H. S. Darling, Lurgan, Co. Armagh (38); Ronald J. Mason, Newcastle, Staffs. (37); J. E. Warburton, Halifax (37).

Twelve Prizes, each consisting of Meccano products to value 5/-: Derek Goligher, Chesham Bois, Bucks. (36); K. W. Cameron, Claughton, Birkenhead (35); A. Farr, London, S.E.23 (35); E. C. Laundon, Barrow-on-Soar, near Loughborough (35); R. W. St. Clair, Bristol (35); A. Jones, Cinderford, Glos. (34); A. Shattock, Northampton (34); T. E. Crowley, Harrogate (34); Thomas Stamford, Selby (34); T. O'Connell, Walton, Liverpool (34); J. C. Prosser-French, Tonbridge, Kent (33); Eric E. Reed, Gourock, Renfrews. (33).

Twelve Prizes, each consisting of a copy of "Famous Trains" by C. J. Allen: Albert Blackburn, Kelvedon, Essex; E. S. Twist, Blaby, Leicester; C. H. Wood, Clapham, S.W.; R. H. Panther, Dalston, E.8; A. K. S. Forster, Southall, Middlesex; F. E. Cocks, Golders Green, N.W.11; J. Hazell, Hartley Wintney, Hants.; W. Colvin, Mossend, Lanarkshire; H. Webb, Wood Green, N. 22; C. W. Gwilliam, Gateshead-on-Tyne; H. Hudson, Heapham, near Gainsborough; R. F. Dudley, Erdington, Birmingham.

Twenty-Four Prizes, each consisting of a Meccano Engineer's Pocket Book: E. L. Print, Aylesbury; G. L. Johnson, Willesden, N.W.10; A. J. Campbell, Gainsborough; J. B. Pinnock, Bedford; A. R. P. Wells, Mill Hill, N.W.7; T. Clark, Strabane, Co. Tyrone; A. W. Marshall, Cromer, Norfolk; D. B. Parsons, Alsager; L. Hollyoak, Coventry; M. Holmes, Baildon, Yorks.; B. Cairns, Dunblane; P. Chappell, West Ealing, W.13; B. Stevens, London, W.6; D. Kelk, London, S.E.23; C. McLean, Ayr; P. Banks, Dunstable; H. A. Thorpe, Hammersmith, W.6; G. S. De Ritter, Prenton, Birkenhead; C. Garlick, Gatley; C. A. G. Meek, Chalfont St. Peter, Bucks.; J. M. Harle, Washington Station, Co. Durham; F. K. Skeggs, Acton, W.3; A. Wiseman, Haverhill, Suffolk; E. Gordon, Bradford.

Section B (for competitors under 14 years of age).

First Prize, cheque for £2-2s.: John Whittle, Wigan (33). Second Prize, cheque for £1-1s.: J. R. C. Elliott, Strabane, Co. Tyrone (30); Third Prize, cheque for 10/6: W. E. Hunt, Ealing, London, W.5 (25).

Twelve Prizes, each consisting of Meccano products to value 5/-: Albert Ellis, Walworth, S.E.17 (24); A. Berry, Gosport, Hants. (24); John Weldon, Gateshead, Co. Durham (24); J. E. Byrne, Mossley, near Manchester (23); A. Storer, Ilford (23); B. L. Simpson, London, S.W.5 (23); M. A. Stokes, Coventry (23); C. J. Bassett, Addiscombe, Croydon (23); R. Johnstone, Birkenhead (23); D. E. Morgan, Bromley (23); H. G. Thurston, Lichfield (20); G. F. Anderson, Seven Kings, Essex (19).

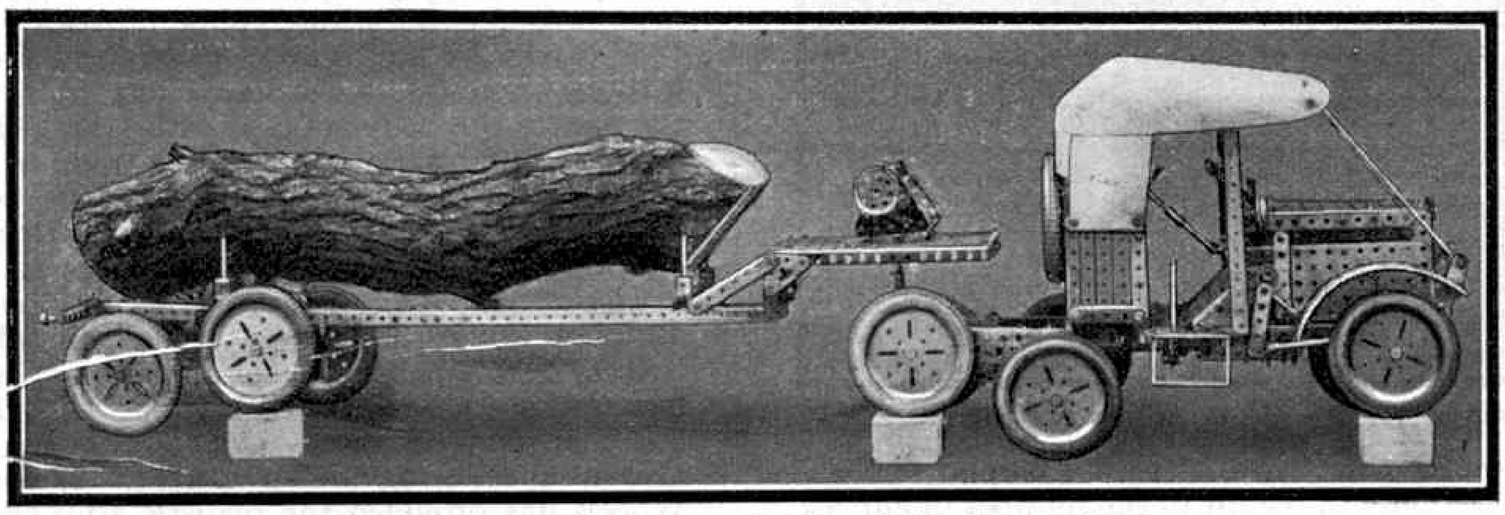
Twelve Prizes, each consisting of a Meccano Engineer's Pocket Book: J. Montagu, Worthing; K. R. P. Benest, London, N.16; R. H. Davies, Evesham; G. Good, Stoneycroft, Liverpool; R. S. Bratherton, Putney, London, S.W.15; G. F. Dawe, Plymouth; G. Chapman, Marnhull, Dorset; E. H. Hare, Chatteris Vicarage, Cambs.; Eric Bednall, Littleover, near Derby; A. W. V. Green, Windsor Park, Belfast; S. H. Rosendale, Upper Norwood, London; J. Hewson, Worthing.

The large number of interesting models entered in Section A make it necessary for this article to be devoted to brief descriptions of the principal models in this Section, but as it would be a pity not to publish details of the outstanding models from Section B, I intend to illustrate and describe some of them when announcing the results in the "Overseas" Section, which closes on 31st January, 1931.

H.M.S. "*Vivacious*" has many times featured as the subject of a Meccano model, but it is doubtful whether this famous warship has ever before been so ably reproduced as it has been by A. M. Messenger, whose fine model is illustrated here. A glance will suffice to show that the model affords a really fine example of sound Meccano construction combined with correct technical design. The good use made of the large variety of Meccano parts employed is re-

markable, and gives an air of completeness to the model. Collars and Couplings, held together on short Rods by Triangular Plates, the whole being pivoted on a 1½" Rod passed through the centre Coupling, form realistic torpedo tubes. A novel feature is the aft capstan, the barrel of which is formed by the boss of a Face Plate incorporated in the deck, and finished off by the insertion of a Bolt in the bore of the boss.

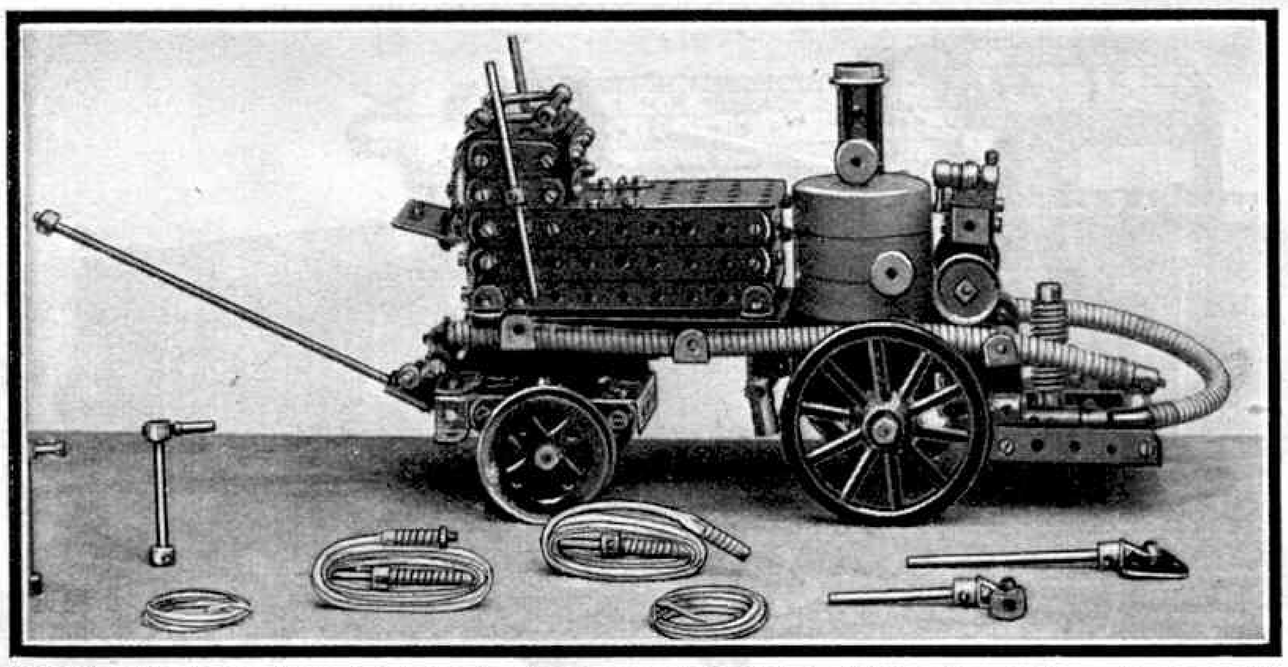
Good work has been done in designing the hull, especially at the stern end, which as will be seen follows closely the lines of an actual T.B.D. With the exception of the flags and the class numbers, the model is constructed entirely from Meccano parts.



K. Garner's model of a ten-wheeled articulated motor lorry.

Since the publication in the August "*M.M.*" of details of the George Bennie Railplane, several model-builders have constructed ingenious Meccano models of this latest railway invention. One of the best that has yet come to my notice is that illustrated here. It was constructed by R. C. Grant and, together with the fine model locomotive shown beneath the Railplane, won one of the major awards in this competition.

It is very pleasing to find readers making use of technical articles appearing in the "*M.M.*" to suggest subjects for reproduction in Meccano, and I would like to see more of these topical models appearing in model-building contests. Many of the wonderful contrivances described in "*M.M.*" articles afford considerable scope for the highest class of model-building, and they naturally attract the attention of the judges far more than models of worn-out subjects. Model-builders in search of new ideas would do well therefore to search through the pages of recent "*M.M.'s*" for they will find abundant scope for their abilities in modelling some of the many splendid machines that have been dealt with in recent articles.



Considerable ingenuity is displayed in the construction of this old-time fire engine. It was built by R. W. Blake, and secured one of the principal prizes in the "Autumn" Contest.

Another unusual type of entry is the cantilever lifting bridge constructed by J. H. Beecroft. This model is copied from the actual bridge over the Nottingham—Grantham Canal in the urban district of West Bridgford, and as I think it worthy of mention in more detail than the space available here will allow, I intend, when opportunity permits, to refer to the model again in a future issue of the "*M.M.*"

Great ingenuity was shown by R. W. Blake in building the model old-time fire engine here illustrated. It is interesting to note that the actual engine from which the model is copied may be seen in the Science Museum, South Kensington, London. It is clear that much patient care was involved in producing this realistic model, and readers will do well to study carefully the good use to which each part employed has been put. Anyone familiar with the old horse-drawn fire engines will realise that Blake's model reproduces in almost every detail the main features of the prototype.

Particularly praiseworthy is the use of five Boiler Ends to form the boiler, Couplings to form the pump, and Worms for the air vessel. With the exception of the suction and delivery pipes, which by the way, comprise pieces of flexible metal gas tubing and white shoe laces, the entire model is built from parts included in the Meccano range.

Kenneth Garner's rigid ten-wheeled motor lorry, also illustrated, needs no words of mine in defence of its claim to one of the major prizes. The model is driven by a Meccano Electric Motor and is fitted with a well-designed gear box giving two speeds forward, reverse motion being obtained by means of the Motor switch. The final drive to the second and third axles is carried out by means of overhead Worms, and use is made of several Meccano Universal Couplings throughout the transmission.

A notable point is the front axle suspension, which is so arranged as to allow articulation of the front wheels to a difference of 2 in. in level. This is carried out by means of a scheme incorporating two quarter elliptic springs arranged in V formation. The overall width of the chassis is 8 in., overall length 3 ft. 6 in., and track on all wheels 7 in.

Garner submitted also a model of a new army tank he recently saw at work on the occasion of War Office trials. Unfortunately the photograph submitted is unsuitable for reproduction.

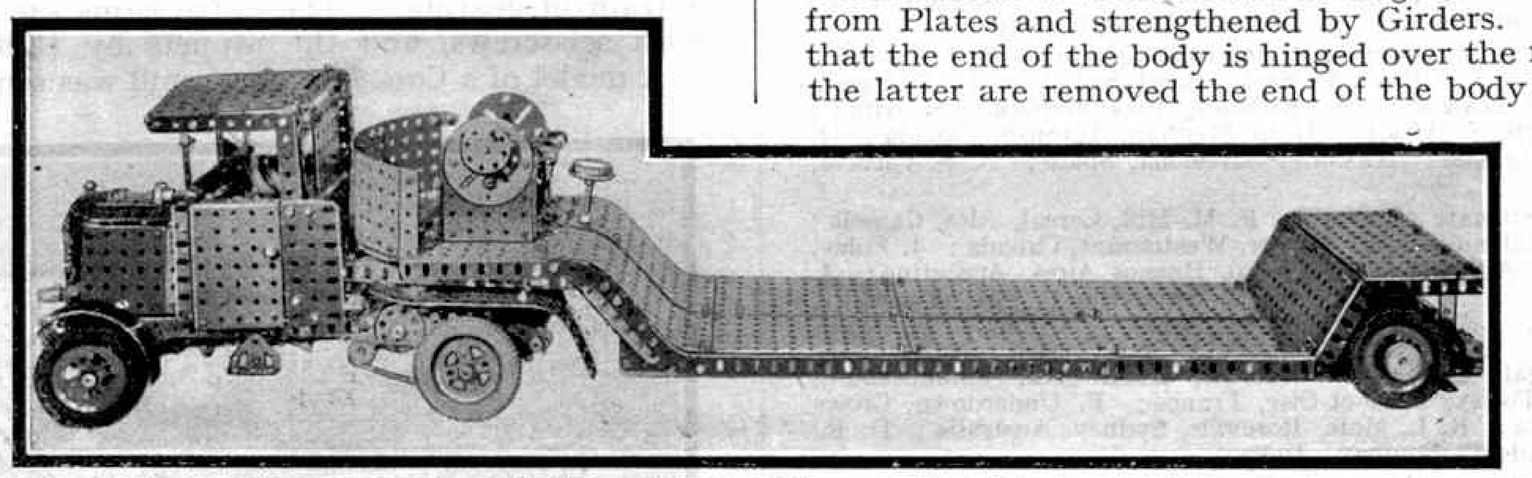
The last of the six competitors who shared the principal prizes is F. S. Beard. This competitor's model is a cargo steamer.

F. E. Paul who was awarded a special prize, obtained only one point less than the first six competitors. His model was a Thornycroft Motor Chassis, and as I hope, if space permits, to illustrate this model in a future issue of the "*M.M.*" I do not propose to deal with it further here.

So many good models yet remain among the prize-winners in Section A that it is hard to pick out those for special mention, and in choosing the entries described below I have endeavoured to select those that I think will be of interest to the majority of model-builders.

The well-built model of a "Scammell" eight-wheeled 25-ton machine carrier won a prize for Stanley R. Davidge. The model represents the latest "Scammell" practice, and is fitted with detachable rear wheels. It is in two distinct parts, the motor unit and the carrier. The former is 14½ in. overall length and is fitted with a three-speed gear box and Ackermann steering, the crank being placed outside the bonnet in the customary Scammell style. The drive is transmitted from the gear box to a secondary shaft, and thence to the road wheels by chains. The rear of the unit is fitted with a faithful reproduction of the Scammell patent turntable.

The carrier is 32 in. in overall length, and is constructed mainly from Plates and strengthened by Girders. A notable feature is that the end of the body is hinged over the rear wheels, and when the latter are removed the end of the body opens out flat and so facilitates the loading or unloading of machinery.



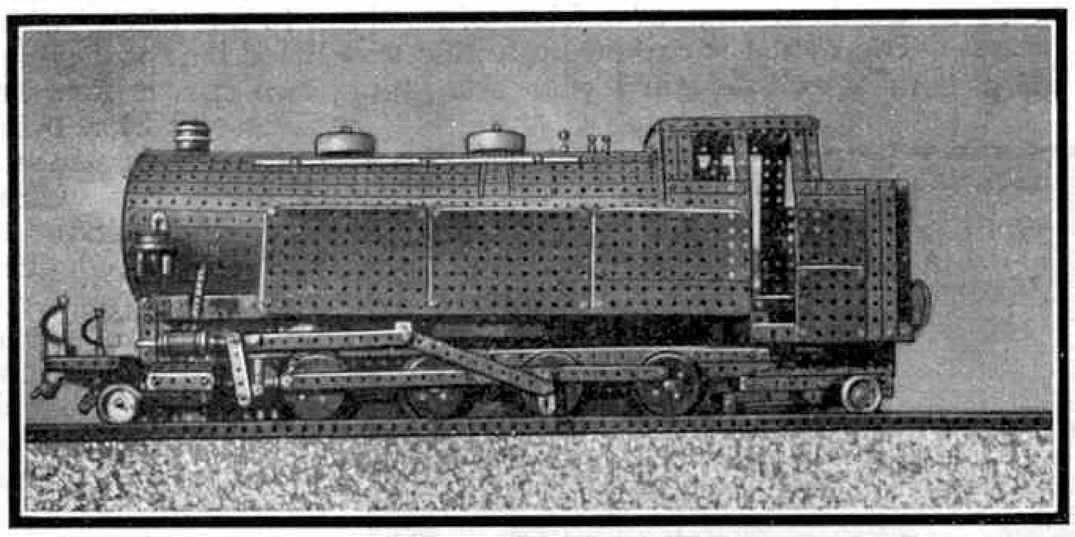
Stanley R. Davidge won a prize with this model of a "Scammell" eight-wheeled 25-ton machine carrier.

A small hand-operated winch with release and automatic locking gear is fixed to the front end of the carrier. The removal of the rear wheels is the work of a few seconds, for each pair of wheels is fitted to an independent carriage, which can be detached simply by removing four bolts.

L. A. Frayn submitted a workable model fret-cutting saw.

A realistic and remarkably sturdy model of a general purpose lathe formed the entry from Ronald J. Mason.

"April" Competition (Overseas Section)



B. South's well-built model of a South African locomotive.

THE Overseas Section of the "April" 1930 Competition was highly gratifying, not only in regard to the number of entries, but also in the superior quality of the models submitted. Bearing in mind that the models were sent from every part of the civilised world, they afford convincing proof that Meccanoites everywhere are steadily making progress in the art of good model-building.

A wide range of subjects faced the judges when they started the task of sorting out the best models. The task was not an easy one as so many different engineering structures were reproduced, but the merits of each model were carefully examined and after long consideration it was decided to allot the prizes as follows :—

FIRST PRIZE, cheque to value £2-2s.: L. Wild, Turin, Italy. SECOND PRIZE, cheque to value £1-1s.: B. South, Pretoria, S. Africa. THIRD PRIZE, cheque to value 10/6.: Bruce D. Baxter, Temuka, South Canterbury, New Zealand.

TWELVE PRIZES, each consisting of Meccano products to value 5/-.: F. Pantanella, Rome, Italy; J. J. Pienaar, Johannesburg, S. Africa; Albert Pilgrim, Leederville, Perth, W. Australia; J. G. Perez, Madrid, Spain; A. S. Adams, Durban, Natal, S. Africa; A. K. Lewis, Cape Town, S. Africa; D. Threlfall, Vancouver, B. C.; A. Shepherd, Bloemfontein, O.F.S., S. Africa; N. Phillips, Durban, S. Africa; Miss N. Bedlington, Milford, Takapuna, Auckland, New Zealand; D. A. Philpott, Wellington, New Zealand; John O'Connor, Sydney, Australia.

TWELVE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: P. L. Bargellini, Florence, Italy; W. Welsh, Ottawa, Ontario, Canada; G. and H. Alington, Invercargill, New Zealand (joint award); R. S. Pearson, Bellvue, Johannesburg, S. Africa; A. N. Rapp, Hobart, Tasmania; N. Broughton, Sea Point, Cape Town, S. Africa; H. N. Walter, Toorak Gardens, Adelaide, S. Australia; A.v.d.Ploeg, Hoofddorp, Holland; A. Cramp, Kogarah, Sydney, Australia; R. Shuttleworth, Wakefield, Nelson, New Zealand; A. L. Fell, Hokianga, New Zealand; C. H. Hulls, Wellington, New Zealand.

TWELVE PRIZES, each consisting of a Meccano Engineer's Pocket Book: B. Sacks, Johannesburg, S. Africa; George Bevan, Montreal, Canada; A. McKellar, Johannesburg, S. Africa; E. Minett, Toronto, Ont., Canada; Yande Waal Malefijt, Arnhem, Holland; Julio Facetti, Buenos Aires, Argentine; P. Dreve, Woerden, Holland; E. Martin, Woodville, North Island, New Zealand; A. Singh, Lahore, India; S. Bodger, Bromley, Christchurch, New Zealand; K. Hobbs, Semaphore, S. Australia; F. H. Mahva, Andheri, India.

NINE PRIZES, each consisting of a "Standard Mechanisms" Manual: R. J. Andrews, Muizen-berg, Cape Province, S. Africa; O. Sacks, Basel, Switzerland; C. Oaten, St. Clair, Dunedin, New Zealand; A. Kidman, Johannesburgh, S. Africa; T.v.d. Spuy, Grahamstown, S. Africa; Hans Stephan, Toronto, Canada; J. Ringnalda, Leeuwarden, Holland; A. Choy, Barcelona, Spain; N. S. Variava, Bombay, India.

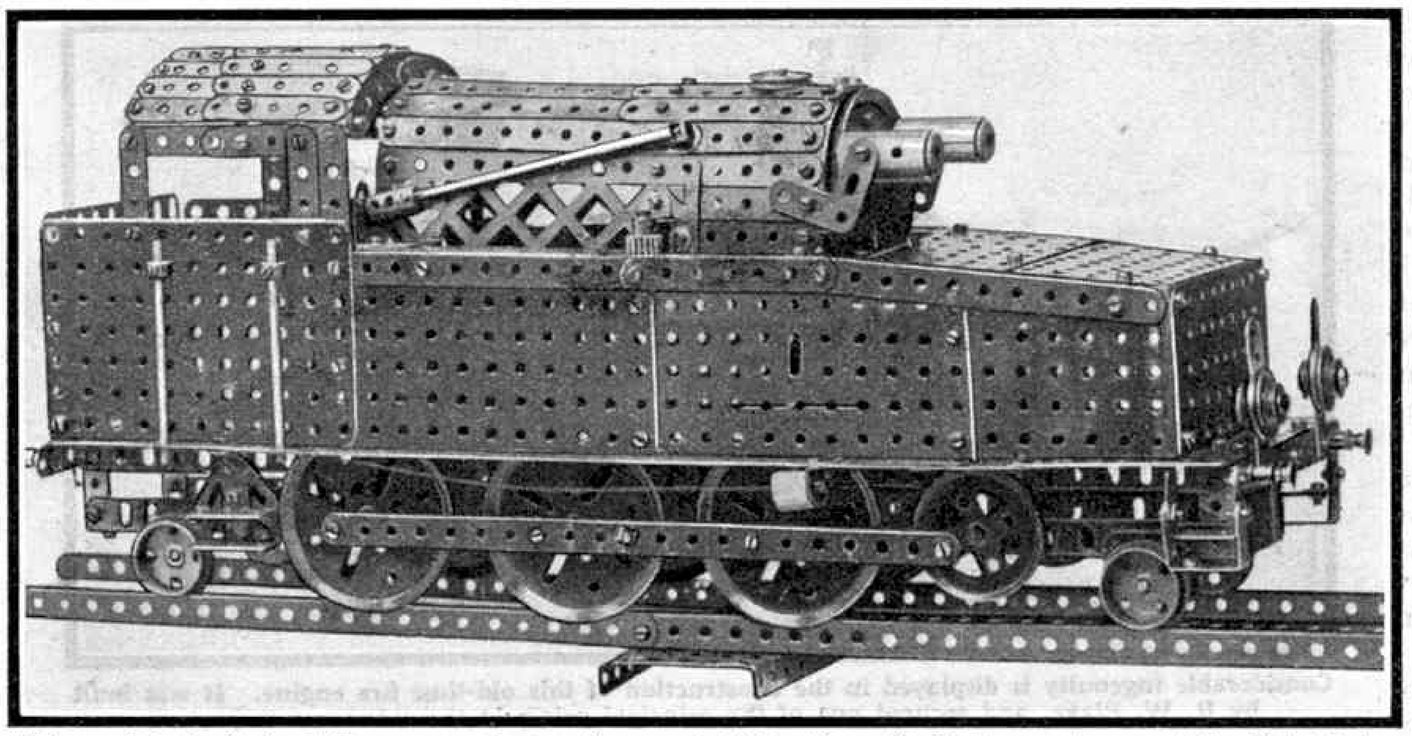
SPECIALLY COMMENDED (Certificate of Merit): F. M. Hill, Cereal, Alta, Canada; H. J. Stuvel, Rijswijk, Holland; T. C. Walker, Westmount, Canada; J. Foley, King William's Town, S. Africa; O. R. Turro, Buenos Aires, Argentine; J. Chico, Barcelona, Spain; A. Hurvyler, Basel, Switzerland; H. Kawalsky, Maitland, C.P., S. Africa; J. W. Ames, Toronto, Canada; N. Parton, Elizabeth Bay, Sydney, Australia; A.B.u.M.Kaeck, Wallisellen, Zurich, Switzerland; M. K. Chaudhury, Bengal, India; S. Kuttner, Kenilworth, Johannesburg, S. Africa; R. Tenaud, Poissy, Seine-et-Oise, France; F. Underdown, Crows Nest, N. Sydney, Australia; R. L. Mote, Roseville, Sydney, Australia; D. R. Heeramaneck, New Gamdevi, Bombay, India.

Models of motor cars are always prominent among competition entries, and the "April" Contest was no exception to the rule, for it was a realistic model of this nature that won the First Prize for L. Wild. The model is illustrated on this page, and its principal attraction lies in the fact that it is arranged for front wheel drive. Unfortunately, however, explicit details of the manner in which the drive is transmitted are not available, but the photographs submitted show that a great deal of painstaking work was necessary both in designing and building the model.

A particularly good feature of the model is its clean design and firm outline—two strong characteristics of the modern motor car. It is driven by an Electric Motor, and the chassis fittings include a three-speed and reverse gear box, and clutch. The tonneau at the rear of the body is fitted with a hinged top and serves to house an Accumulator for supplying current to the Electric Motor, and also for lighting the two headlamps with which the car is equipped. Excellent use is made of Meccano Springs in forming collapsible tie-bars for the hood.

The winner of the Second Prize, B. South, built a model which, although not outstandingly original in subject, certainly deserved success from a constructional point of view. It is a South African locomotive and is illustrated here. A particularly good bit of work has been done in the cylinder and valve chest construction, and also in reproducing the valve gear. The use of 1½" diam. Flanged Wheels has provided the realistic stub chimney common to these engines. A noteworthy feature is the construction of the driving wheels. Wheel flanges are secured with their faces butted against the Face Plates instead of outwards as in usual Meccano practice.

The Third Prize was awarded to B. D. Baxter for a fine working model of a Swiss high-pressure locomotive, also illustrated. The model is based on the engine described on page 278 of the "*M.M.*" for April last. Features of special interest are the protective cowls over the openings in front of the smoke-box, through which air for combustion is taken in and carried directly to the grate. The cowls are formed from Sleeve Pieces and Chimney Adaptors, and they are held in position by means of Simple Bell Cranks fixed to the smoke box. The extremely low funnel of the prototype is reproduced faithfully with a 1" loose Pulley! Two headlights, comprising Pulleys, steps for "boarding" the locomotive, and leading and trailing two-wheel trucks, are other points of interest.



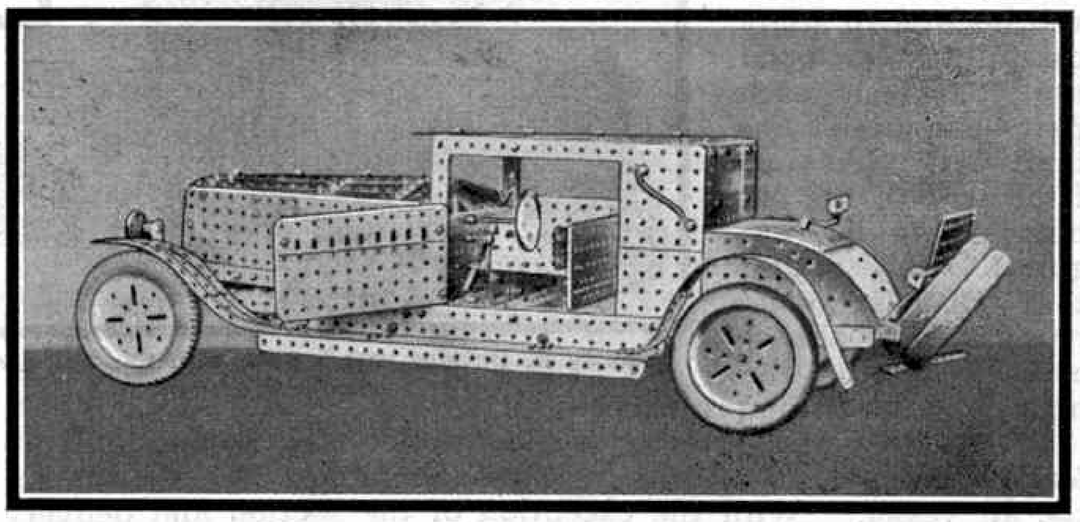
This model of a Swiss high-pressure locomotive was built by Bruce D. Baxter, and secured the Third Prize.

A. S. Adams secured an award with a model of a V-type twin cylinder motor cycle engine. This ingenious model is complete with overhead camshaft, working pistons and valves. The crankshaft revolves in a crankcase, which is provided with two flats on which the cylinders are rigidly bolted.

The pistons are formed by attaching two Wheel Flanges together with the flanges butted face to face and fixed by bolts. A "magneto" is fitted and is arranged to complete an electrical circuit with each of two lamps, which represent the "sparking" plugs. The "magneto" is so "timed" that on completion of the compression stroke the lamps are illuminated; current for the purpose being supplied by dry cells.

The overhead camshafts operate the inlet and exhaust valves at regular intervals, and are driven from the crankshaft through a train of gearing. The valve cams are represented by Collars with set-screws, and the tappets by Buffers.

A model of a Canadian grain mill was sent (*Continued on page 96*)



A neat coupè motor car by L. Wild.

SPADE TAGS.—We have examined your idea for brass spade connectors that could be secured to the ends of flex leads and the "spade" portion clamped under a standard Terminal in an electrical model. These special tags would certainly enable a neat connection to be made, but we would point out that an effective connection can be formed by first baring the end of the flex and twisting the strands together, and afterwards forming the twisted strands into a loop that can be passed round the shank of the Terminal. For this reason we consider your special connector unnecessary. (*Reply to K. T. Price, Sheffield*).

SPECIAL ACCUMULATOR.—We do not propose adding a "boat" type 6-volt Accumulator to the system for although this would be compact it would not be economical in operation. (*Reply to C. Ray, Brighton*).

SPRING WASHERS.—We were interested in your idea that special double coil spring washers should be introduced. These would be particularly useful in obtaining smooth working in bolt and lock-nut pivot mechanisms. We are giving this idea careful attention. (*Reply to D. G. Fernley, Stoke-on-Trent*).

MILLED NUT.—A metal disc milled around its periphery and having a standard Meccano tapped hole cut in its centre, would doubtless be useful in screw adjustment mechanisms. We are considering the idea, and in the meantime we suggest that you use a Threaded Boss, as this will be found to function quite well. If a "wing" or "butterfly" type of adjusting nut is required, two bolts can be screwed into the lateral tapped holes of the Boss to produce the required effect. (*Reply to C. R. Goddard, Edinburgh*).

NARROWER RACK STRIP.—Your suggestion that the Rack Strips should be manufactured slightly narrower, so that they can be passed through a standard Eye Piece, is interesting. It would be difficult to find many instances where such a combination of parts could be used, however. Perhaps you will let us know the purpose you have in view in suggesting this alteration? (*Reply to B. Lunt, Darlington*).

ALTERATION TO CRANK.—Your suggested alteration to the method of perforating the web of the Meccano Single Arm Crank is interesting. Your idea would be to cut a circular hole in the end of the crank and place the slot, which is at present at the end of the web, close to the boss. The purpose of this alteration would be to eliminate the reinforced bearing that is necessary when the crank is used in the construction of a large crankshaft. This would certainly be an advantage in one or two models, but we would point out to you that the slot in the crank enables a "vernier" adjustment of the throw to be made, when the part is used in conjunction with the lock-nut mechanism (S.M. 262) in simple models. We are nevertheless considering your idea. (*Reply to R. Redwood, Hull*).

DRY BATTERY.—Your suggestion that a special 6-volt dry battery should be added to the system is interesting. A dry cell of this voltage could be used to light the Meccano 6-volt miniature Electric Lamps, and it could always be employed for operating relays and similar electrical mechanisms where the resistance of the circuit was relatively high. A dry cell of this type would not be suitable for use in low resistance circuits, such as the Meccano 6-volt Electric Motor, or solenoids wound with heavy gauge wire, and an Accumulator or Transformer must be used here. In the majority of models incorporating Electric Lamps a Motor is also fitted, and the Lamps can be lit from the Motor power supply. In the few models where this is not the case, the special dry cell would be useful, and we are therefore keeping your idea in mind. (*Reply to M. A. Rankin, Ormskirk*).

NEW CLOCKWORK MOTOR.—We were particularly interested in your proposed design for a new clockwork motor. The spring and gearing forming the Motor would be enclosed in a casing resembling an internal combustion engine cylinder and crankcase unit, the 'crankcase' housing the spring, while the "step-up" gears would be mounted on rods journalled in the "cylinder" portion directly above the spring. A motor designed on these lines would certainly be novel and attractive, but we are afraid that the motor would be rather inadaptable and it would be difficult to fit it into certain of the simpler models. We are nevertheless keeping your idea in mind as it possesses some very good features. (*Reply to F. N. W. Millman, London, N.18*).

ROD BRACKET.—A special bracket for supporting or guiding standard Axle Rods is an ingenious idea, and no doubt it would be possible to find a number of applications for this part. The suggested bracket would resemble a Flat Bracket having one end turned over so that a Rod could be passed into the loop thus formed. A part of this type would not be very strong mechanically, but it would be cheap to produce, and doubtless would be quite effective in light constructional work. For heavier work you will find that a Meccano Handrail Support is particularly suited for supporting a standard Axle Rod. (*Reply to F. Johnson, Bristol*).

IMPROVED SCIENTIFIC HOOK.—We note your idea that a number of "notches" should be formed in the straight portion of the Scientific Hook (part No. 57a) so that a Meccano Gramme Weight would be prevented from sliding up and down on the Hook as at present. There would be little advantage in doing this, however, and the improvement resulting from your suggested alteration would hardly justify the cost of alteration. (*Reply to P. R. Higgins, Stockport*).

Cash Prizes for Bright Ideas

Every month many interesting suggestions regarding additions and improvements to the Meccano system are forwarded to us. Each idea is given careful consideration, and the suggestions possessing the greatest general interest are published in these columns. In order to introduce the spirit of friendly rivalry among contributors to this section, we have now decided to award each month a prize of 10/- to the reader who submits the most ingenious idea. Every model-builder should therefore make a point of sending in his ideas, as they may quite easily be the means of providing useful "pocket" money.

It should be clearly understood that the award of 10/- will be made for the most interesting idea received during each individual month. Home and Overseas readers are thus on exactly the same footing, as all the suggestions that arrive during any one month are considered together at the end of that month.

The most elaborate idea will not necessarily carry off the award—in fact a simple but ingenious suggestion thought out by the owner of a 000 Outfit is just as likely to do so! Any number of ideas may be submitted by readers each month, but each suggestion submitted should be written on a separate sheet of paper and the name and address of the sender should appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

SOLENOIDS.—Electric solenoids for use in the model Four Cylinder Electric Engine, etc., cannot be supplied ready wound. You will find it quite a simple matter to wind these solenoids. For this purpose you will require a reel of Meccano 26 gauge SCC copper Wire (part No. 313) and a Bobbin (part No. 301). The end of the wire should first of all be passed through one of the holes in the fibre end of the Bobbin, and the latter should then be wound to capacity. On completing the winding, the wire should be cut and the end passed through the second hole in the fibre end piece. Finally a strip of stiff paper should be wound round the Bobbin and secured by a dab of glue so as to protect the windings from damage and accidental "short circuits." (*Reply to J. R. Field, Bury*).

SPECIAL HINGE.—We note your suggestion that we should introduce a hinge having lugs resembling Angle Brackets. This would be quite a useful part as it would enable doors, etc., to swing through a much wider angle than is at present possible with the standard pattern Hinge. This type of hinge would not be as compact as the present pattern, but it would possess distinct advantages in operation. We are considering your suggestion. (*Reply to D. Stewart, Birkenhead*).

IMPROVED THREADED BOSS.—If an additional threaded hole were tapped in the standard Threaded Boss, the adaptability of this part might be increased slightly. The additional hole would be placed at the opposite end to the existing lateral tapped hole, and it would be at right angles to the latter. We are considering this suggestion. (*Reply to C. Hickson, York*).

NEW GIRDER.—A number of uses could be found for $1\frac{1}{2}'' \times \frac{1}{2}''$ section channel girders. Girders of this section could, for instance, be used "back to back" to form a massive I-section girder for the boom of a large crane or the framework of a warehouse or other Meccano structure. Many other uses for a part of this type will suggest themselves to readers, and we shall certainly consider the introduction of the part. (*Reply to D. Lewis, Warrington*).

SPECIAL AIRSHIP PARTS.—We were interested in your suggestion that special parts such as rudders, engines, cars, etc., should be added to the system for use in models of airships. We cannot do this at the present, however, but suggest that you make these special parts from cardboard, sheet tin, etc. (*Reply to P. Bailey, Brighton*).

REVERSING SWITCH FOR E1 MOTOR.—A special reversing switch unit for use with the new E1 Motor would no doubt prove quite useful, but it would be expensive to produce, and a number of alterations would be necessary in the design of the motor itself. If you particularly wish to employ electrical reversing gear for the Motor you can build a "double-pole-double-throw" switch from standard parts and connect this between the Motor and the Accumulator or transformer; but you will find it simpler to employ a mechanical reversing arrangement in the transmission gear of the model. Several types of reversing gears are shown in the Meccano Standard Mechanisms Manual and we suggest you use one of these. (*Reply to T. Bottomly, Crewe*).

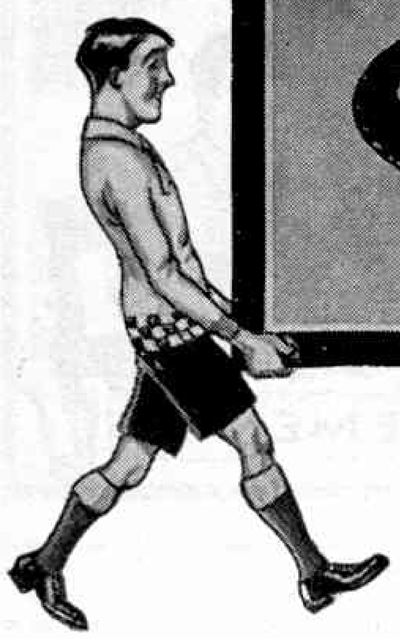
RUBBER TYRES.—We have noted your suggestion that rubber tyres designed to represent the "solid" tyres used on heavy commercial vehicles should be introduced. Many models of heavy commercial road vehicles are constructed in Meccano and no doubt there would be quite an extensive application for the parts. We are considering this suggestion, and in the meantime we remind you that while the existing "pneumatic" type Tyres are not as suitable for the above purpose as your suggested tyres, they are nevertheless very realistic accessories, and you will not go far wrong in fitting them to your model motor vehicles. (*Reply to D. R. Fisk, Adelaide, South Australia*).

IMPROVED SIGNAL.—Your idea that we should colour the Meccano Distant Signal (part No. 158b) yellow and black in accordance with the latest railway practice is good and we are giving special attention to the suggestion. (*Reply to R. G. Griffiths, Matlock*)

SMALL FLYWHEEL.—Your suggested small size flywheel (the rim to be about $1\frac{1}{2}''$ diam.) would no doubt prove a useful part. As you point out, a heavy wheel of this size could be used as the flywheel in a model motor chassis, and numerous other uses could no doubt be found for the part in small mechanisms. The drawback to producing a small diameter flywheel is that it is incapable of storing much energy, and the "flywheel" effect is not very apparent except when running at very high speeds. Nevertheless we are considering your idea. (*Reply to F. Johns, Birmingham*).

WINCH BARREL.—Your design for a special drum for use in the hoist movement of Meccano cranes and in winches and other gears, is interesting. Although your suggested part would be useful in many models, several quite effective drums can be constructed from existing parts. For instance, a Meccano Wood Roller forms an excellent drum in large models of cranes, etc. In small models, a number of Couplings mounted on the shaft can be used as a drum or four $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted between Bush Wheels secured rigidly to the shaft will function efficiently. Another useful form of drum can be constructed by pushing $\frac{3}{4}''$ Flanged Wheels over the ends of Sleeve Pieces, which are clamped to the hoist shaft. In spite of the fact that drums can be built up as described, we are considering your suggested special part, as it would be both neat and efficient. (*Reply to P. Moore, Wellington, New Zealand*).

SPECIAL GEAR.—It would not be advisable to supply the "face" portion of the 57-teeth Gear Wheel without the boss and set-screw. We agree that the part might be of use to constructors who had a good supply of Bush Wheels, but the slightly lower cost at which the 'toothed discs' could be supplied would not compensate for the loss of efficiency and compactness that would result from the use of a built-up gear of this type. (*Reply to L. K. Craig, Edinburgh*).



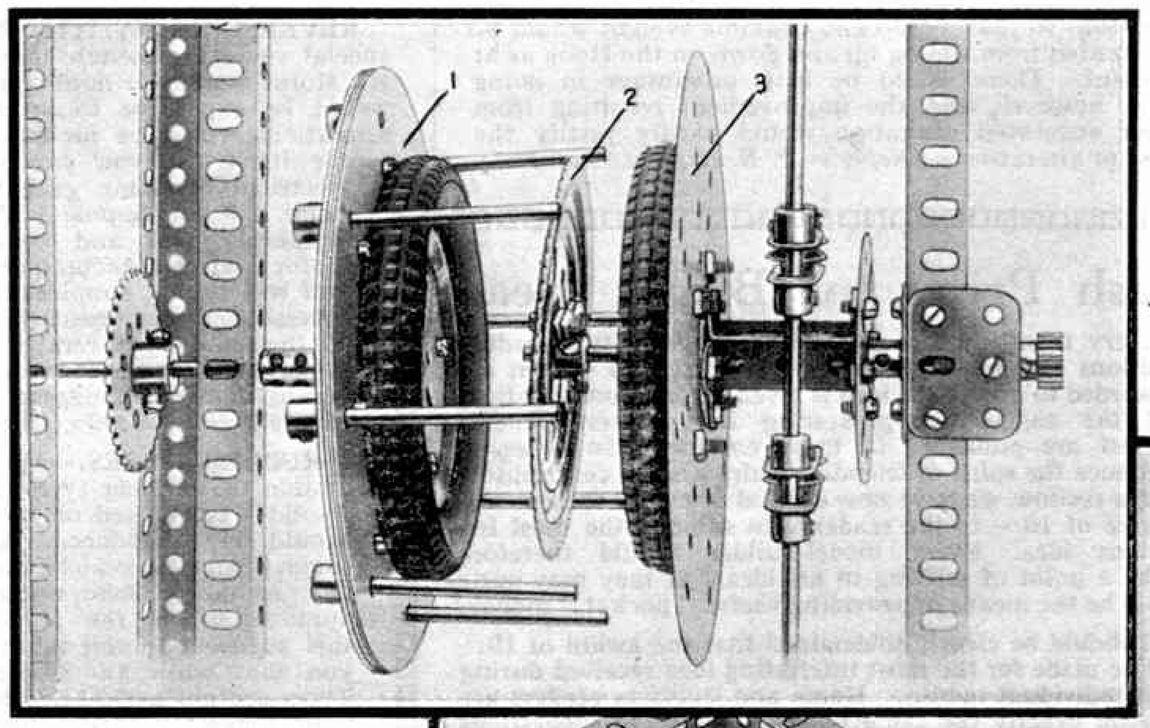
Suggestions Section

Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(211)—Demonstration Model of Single Plate Clutch

From a very early stage in the history of the motor car, clutches of various types have been standard fittings to all models. It was found at the outset by the pioneers of motoring that a gearbox was necessary in order to obtain increased speed and efficiency from the engines then in use; and, to facilitate a change from one gear ratio to another, some means had to be provided for disengaging the motive power for a short time while the operation was effected. This was accomplished by means of a clutch. Like every other part of a motor car, the clutch has undergone improvement and the leather-faced clutches formerly used have been replaced by more efficient devices in which metal plates are employed. Modern clutches may have one or more plates that are pressed forcibly into contact with each other in order to transmit the movement of the engine, but the present model is one of a typical single-plate clutch that is very interesting to build and operate, and is specially useful for demonstration purposes.



(Top) Fig. 211. Single Plate Clutch dismantled. (Bottom) Fig. 211a. General view of Clutch.

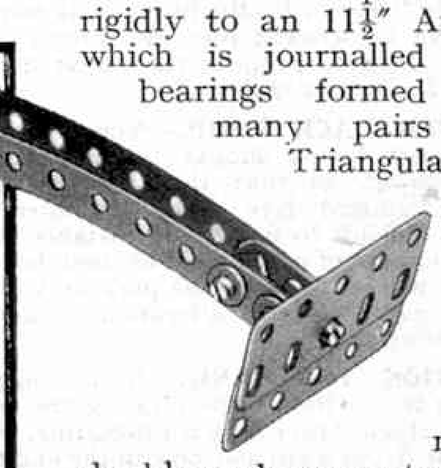
A suitable framework should first be built on which to mount the clutch unit, and its construction should be easy to follow from Fig. 211a. The unit itself embodies several important parts, the main ones being the flywheel 1, the floating plate 2, and the withdrawal plate 3. These are shown, in Fig. 211, separated from each other in order to make matters clearer. The flywheel is built up from five 6″ diam. Circular Plates, with a Bush Wheel as a boss; and to the flywheel is bolted a 3″ Pulley Wheel with Dunlop Tyre that represents the "Ferodo" disc of the actual clutch. The flywheel is secured rigidly to the crankshaft, which is a Meccano Rod driven by an Electric Motor through a Sprocket Chain drive. It should be noted that the 3″ Pulley must be bolted very tightly to the flywheel in order to provide a space in which the floating plate 2 can move freely when necessary.

The floating plate consists of the geared portion of a Ball Race (part No. 168b) attached to a Bush Wheel with $\frac{3}{8}$″ Bolts in such a manner that it is able to slide longitudinally for a short distance. The Bush Wheel is secured to the secondary or driven shaft, the tip of which runs freely in the boss of the 3″ Pulley Wheel that is bolted to the flywheel.

The withdrawal plate consists of a 6″ diam. Circular Plate to the centre of which a Face Plate is attached by means of $1\frac{1}{2}$″ Double Angle Strips, so that both rotate freely upon the Rod as a single unit. A second 3″ Pulley Wheel with Dunlop Tyre, which is bolted on to the plate, forms a second "Ferodo" disc.

The flywheel and the withdrawal plate revolve as one. They are connected as shown by 2″ Axle Rods fixed to the former by means of Cranks and passed through corresponding holes of the withdrawal plate, Compression Springs on the rods serving to keep the plate normally hard up against the driving member of the clutch. The Springs are retained in place by Collars.

The withdrawal mechanism should now receive attention. An efficient clutch pedal is made from $5\frac{1}{2}$″ Angle Girders and Curved Strips, together with two $2\frac{1}{2}$″ Flat Girders, as shown in the illustration. The pedal is fixed rigidly to an $11\frac{1}{2}$″ Axle Rod, which is journalled in four bearings formed by as many pairs of 1″ Triangular Plates.



The withdrawal forks are secured very rigidly by double grub-screws to the same Rod, and each consists of a pair of Cranks fitted with a roller in the shape of a $\frac{1}{2}$″ loose Pulley. The Pulleys are mounted on Threaded Pins secured to the Cranks, and they are spaced centrally by Washers. When the pedal is depressed, the forks press against the edge of the Face Plate and bring the withdrawal plate out of contact with the floating plate, thus freeing the latter from the drive.

It should be noted that to limit the movement of the clutch pedal this member is extended below the $11\frac{1}{2}$″ Rod by means of a $2\frac{1}{2}$″ large radius Curved Strip, which is restricted in its movement by Threaded Pins secured to the framework. A Spring, which is attached to the bottom of the $2\frac{1}{2}$″ Curved Strip and to a $\frac{3}{4}$″ Bolt affixed to the framework, assists the clutch pedal to return to the normal position after operation. Owing to the fact that the withdrawal mechanism is subject to very great strain in operation, it is advisable to use two grub-screws in each of the Cranks.

It will be realised, of course, that this model cannot be incorporated in a Meccano Chassis on account of its large dimensions, and it is, therefore, only suitable as a demonstration model for showing the working principles of a single plate clutch.

(212)—Differential for Sprocket Drive

(W. Chambers, Pleasley, Notts)

The general layout of the differential gear shown in Fig. 212 should be fairly clear on reference to the illustration. The "cage" containing the ¾" Contrate Wheels and the Pinions that form the differential proper, consists of a 2" Sprocket Wheel (forming the driven member) and a Bush Wheel, which are free on the road wheel axles, and are connected together by two 1½"×½" Double Angle Strips. The inner ends of the axles terminate in ¾" Contrates in constant mesh with ¾" Pinions mounted loosely on a short transverse Rod that is held in the transverse centre hole of the Coupling.

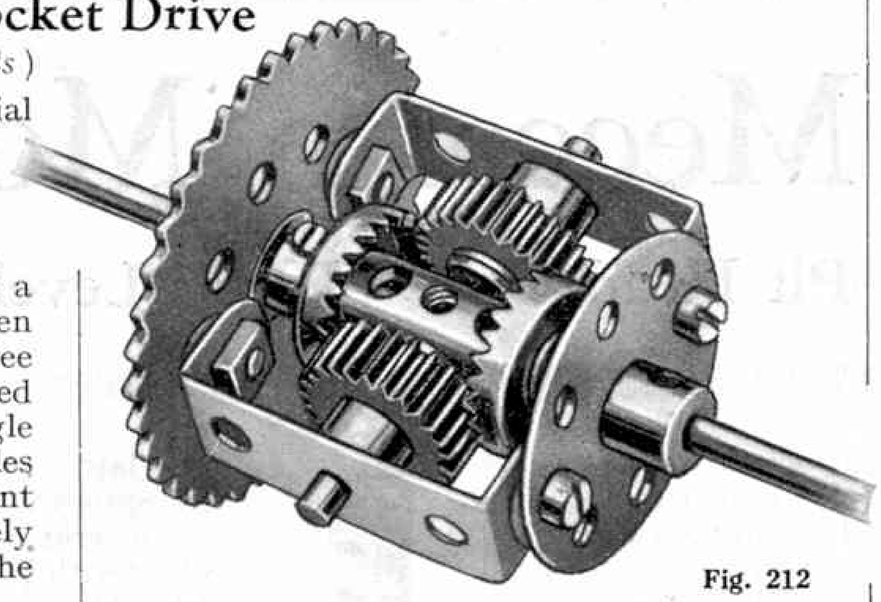


Fig. 212

(213)—A Novel Hand Drill

A hand drill that is suitable for light work has been submitted by R. Nott (Letchworth, Notts.). It consists of a Rod to each end of which a Coupling is secured. One Coupling serves as a drill chuck, while the other has a length of cord passed through its end hole, and the ends of the cord are held to each end of a 5½" Strip. When the device is working, the loop of cord continually winds and unwinds itself from the rotating Rod, and by pushing downward on the Strip at the right moment, the drill is kept rotating. In the original device there is no means provided for steadying the upper end of the rotating Rod. It would be an advantage, therefore, to mount a 3" Pulley loosely on the end of a short Rod that is held in the longitudinal bore of the upper Coupling. Fretwork, or small twist drills may be employed with the device.

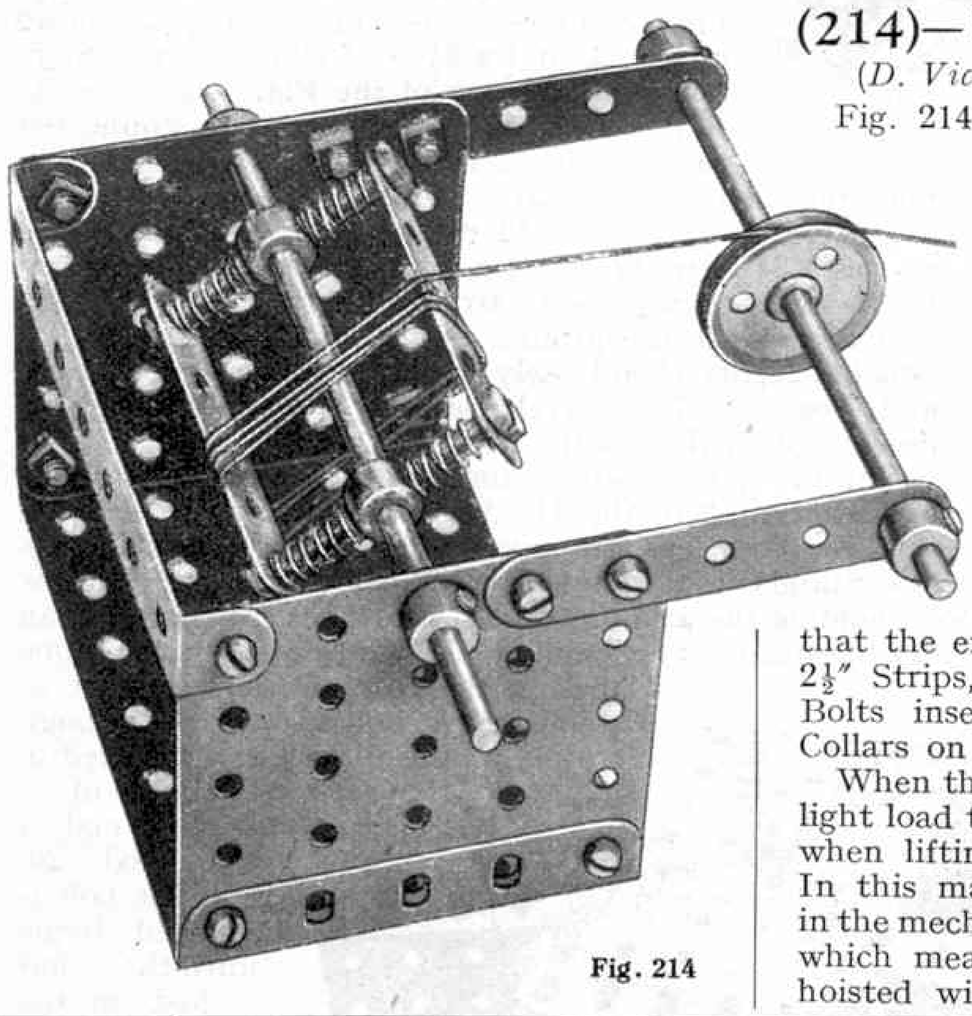


Fig. 214

(214)—Self-Adjusting Winch

(D. Vickery, Prestwich, Manchester)

Fig. 214 illustrates an interesting type of winch. The most notable feature of the model lies in the fact that it accommodates itself to variations in the weight of the load, so that a heavy load may be hoisted just as easily as a much lighter one. This is accomplished entirely automatically by the employment of an expanding barrel round which the hoisting cord is wound.

It will be seen from Fig. 214 that the expanding barrel consists of two 2½" Strips, which are mounted on Pivot Bolts inserted in the tapped holes of Collars on the winding shaft.

When the winch is engaged in hoisting a light load the barrel is fully expanded, but when lifting a heavier load it contracts. In this manner a gain is brought about in the mechanical advantage of the machine, which means that a heavy load may be hoisted with comparative ease.

(215)—A Novel Overflow Indicating Device

(L. Best, Ramsgate)

The device shown in Fig. 215 is intended for use in connection with an aquarium or a water tank of any kind, to give an alarm immediately the water has reached such a level that it commences to overflow. The model is fitted below the end of an overflow pipe arranged to come into action at the desired level, so that the first drops of overflow water fall on to a strip of blotting paper 1. One end of the strip of paper is clamped between a Flat Bracket and a ½"×½" Angle Bracket, while its other end is attached similarly to a 1"×1" Angle Bracket 2. This Angle Bracket has bolted to it a Double Bracket, which is mounted freely on a short Rod that is held in Angle Brackets on the base plate. A 6 B.A. Bolt and Terminal 3 is secured to the Angle Bracket 2 and is insulated from it by means of an Insulating Bush and Washer. A second 6 B.A. Bolt 4 is secured in metallic contact with the Plate, and in such a position that it is vertically below the Bolt 3. A terminal is secured to the Plate in the position indicated, and this is also in metallic contact with the Plate.

Immediately water falls on to the strip of blotting paper the paper softens, and breaks under the tension of two lengths of Spring Cord. The Bolt 3 then makes contact with the Bolt 4, thus completing the circuit and bringing into operation a bell or other alarm mechanism.

The indicator is placed in series with the battery and the bell, so that the current flows across its contacts on the way to the bell.

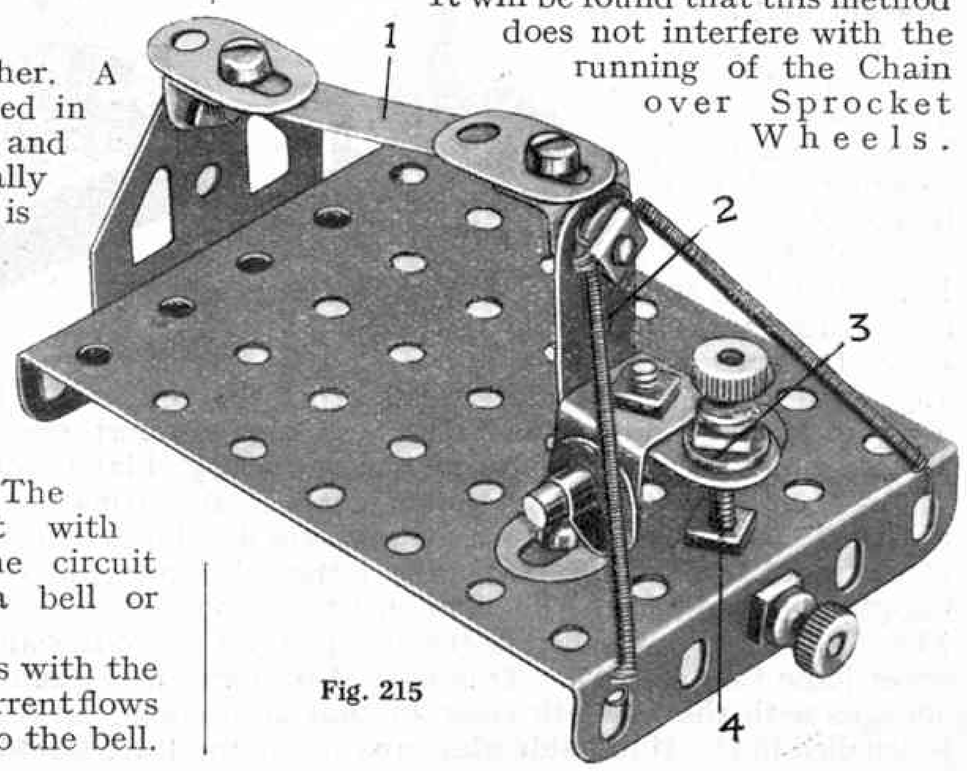


Fig. 215

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutua help in which they are advanced.

(M.100). Chessmen in Meccano.—M. Campbell (Dumbarton, Scotland) has sent us details of a set of chessmen that are sure to interest Meccano boys who are chess enthusiasts. The pawns are 1" fast Pulleys and 1" Rods, coloured paper being gummed round the Rods as an aid to distinction. The King consists of a Flanged Wheel for the base and a ¾" Contrate Wheel, while the Queen is a 1" Gear, a 1" Bevel and a ½" Pinion, all secured together on a Rod. The remaining pieces are also given shapes that correspond as closely as possible with the actual men. The idea is certainly ingenious, and it only now remains for some other contributor to send in a suggestion for a chess board!

(M.101). A Meccano Shuttle.—A very ingenious yet simple shuttle for the Meccano Loom has been devised by G. Hugel (Mulhouse, France). It consists essentially of a shell and a bobbin. The shell is composed of three 2½"×½" Double Angle Strips, which are bolted together to form a lidless box, and the bobbin is a short Rod that is journalled in a 1½"×½" Double Angle Strip. The weft thread is wound on to the bobbin which, together with the Double Angle Strip, is placed in the shell. It will be found necessary to increase the throw of the cranks that operate the lifting mechanism of the heald frames in order to prevent the blunt nose of the shuttle fouling the warp threads when the shuttle is thrown across the slay.

Many Meccano boys will welcome Hugel's novel shuttle and will find that it is quite capable of turning out good work, although, of course, the use of the Meccano Shuttle is to be preferred, as this is specially designed for the purpose.

(M.102). Attaching Parts to Sprocket Chain.—Model-builders must have often felt the want of some means of attaching Flat Brackets to lengths of Sprocket Chain, so that Angle Brackets and similar parts may be attached to the Chain. R. Hastings (Buenos Aires) has solved the problem in a very simple manner by forming a portion of the Sprocket Chain into a loop, pushing the loop through the slotted hole of a Flat Bracket, and then inserting a short Rod or Bolt through the bight of the loop to prevent it pulling out. It will be found that this method does not interfere with the running of the Chain over Sprocket Wheels.

New Meccano Models

Mechanical Man—Pit Head Gear—Toplis Level Luffing Crane

AMONG the many mechanical marvels that scientists tell us will be common sights in the year 2031 A.D., none can be of greater interest than the " robots " or mechanical men which, we are assured, will be used to perform almost every action of a human being. Meccano boys may well envy their fellow constructors of the next century using a " squad " of these " mechanical humans " to do their homework while they complete a model of a super 500 m.p.h. land plane, or the latest pattern of a moon rocket!

Although the remarkable Meccano model robot described this month is not capable of working out Square Roots or Compound Interest, it will nevertheless walk forward in a remarkably realistic manner, merely by pressing one of the 1″ Pulley Wheels that represent this weird individual's " ears "!

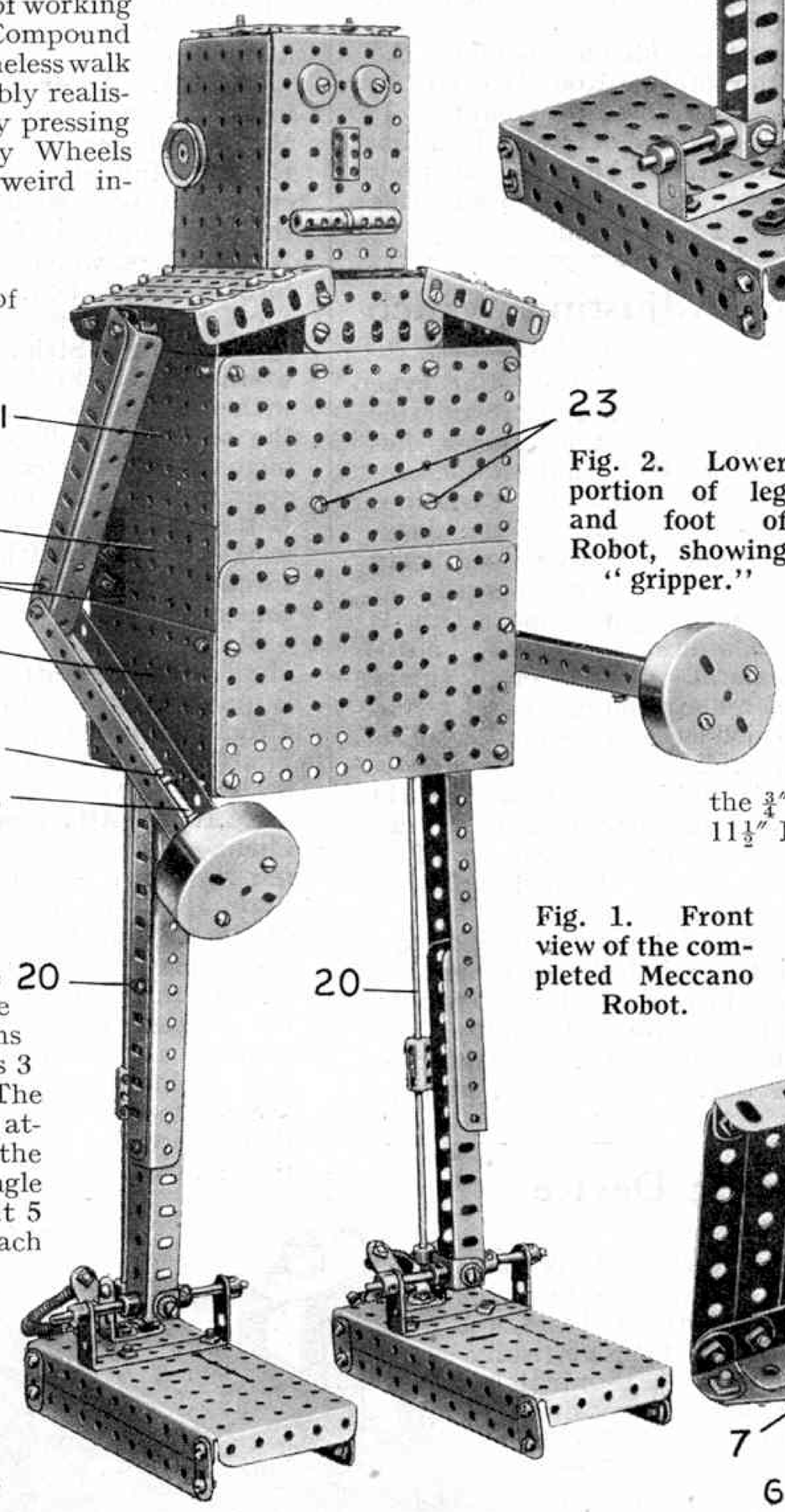


Fig. 2. Lower portion of leg and foot of Robot, showing " gripper."

Mechanical Man

The construction of the model should be commenced by building the Robot's body. The front and back of the body consists of four 5½″ × 3½″ Flat Plates joined together at the sides by means of 3½″ × 2½″ Flanged Plates 1 and 5½″×2½″ Flat Plates 2. The 5½″ Angle Girders forming the arms have attached to them Boiler Ends, inside which are 2″ Pulleys, and the " fists " so formed are attached to the arms by means of 2½″ Rods 3 and Collars 4. The complete arms are attached by ¾″ Bolts to the shoulders and an Angle Bracket and a ½″ Bolt 5 are used to secure each elbow to the body. The construction of the head and shoulders will be seen in Fig. 3.

The 3½″ × 2½″ Flanged Plates forming the head are bolted to the top ends of the 12½″ Girders 6. These girders run from the top of the head to a point halfway down the body, and also support the Electric Motor, which is attached by means of the 2½″ Flat Girders 7.

A 57-teeth Gear and ½″ Pinion connect the armature spindle to the 2½″ Rod 8 on which is fixed a Worm 9. This engages with a ½″ Pinion 12 on the Rod 10, the latter also carrying two loose Couplings 11 and 11a. The Pinion 12 engages with a ¾″ Contrate 13 on a 1½″ Rod journalled in the side plate of the Motor and in the lower loose Coupling 11. This Rod also carries a ½″ Pinion which engages with the 57-teeth Gear 14 that is mounted on a 1½″ Rod journalled in the Motor side plate and in the top loose Coupling 11a.

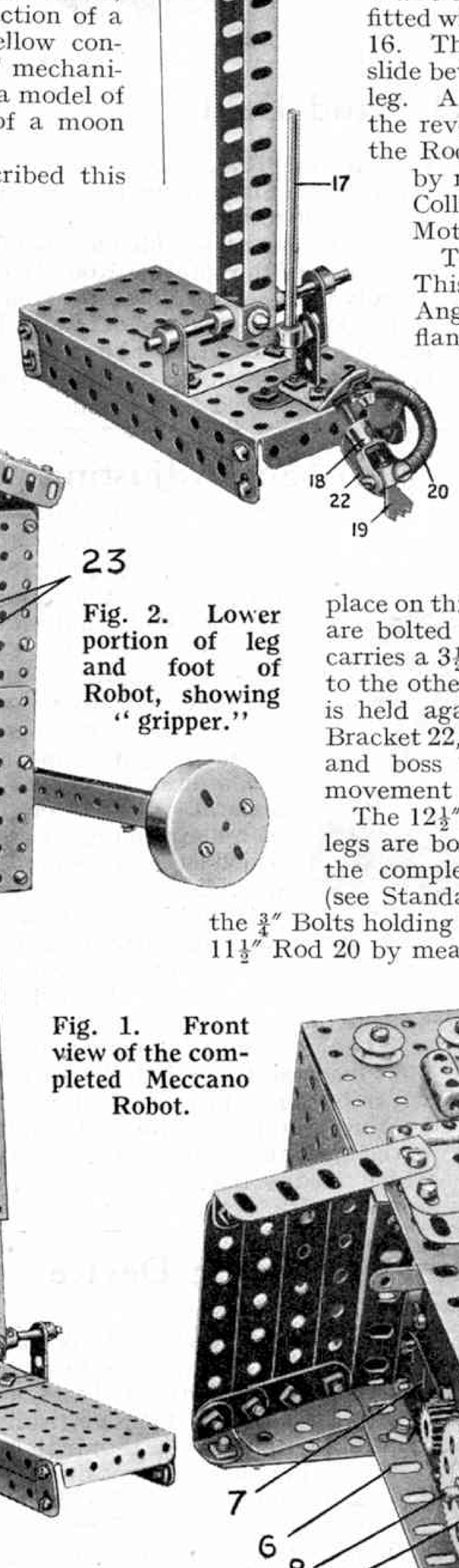


Fig. 1. Front view of the completed Meccano Robot.

The latter 1½″ Rod is connected to the crankshaft 15 by Sprocket Chain as shown in the illustration.

The crankshaft carries two Bush Wheels 21 that are fitted with ¾″ Bolts on which are mounted loose Pulleys 16. These Pulleys are spaced by Washers so as to slide between the two 12½″ Angle Girders forming each leg. A short Rod engaging with one of the holes in the reversing lever of the Electric Motor is fixed to the Rod holding the 1″ Pulleys forming the " ears " by means of a Coupling and held in place by two Collars. By pressing either of the Pulleys the Motor can thus be started or stopped.

The Motor unit may now be fixed in place. This is accomplished by bolting the two 12½″ Angle Girders to the back of the body and the flanges of the Motor to the front. Two ½″ Bolts 23 spaced by Washers are used to secure the latter.

The feet should next be made, each being constructed similarly. A 5½″×2½″ Flanged Plate is raised on 5½″ Strips as shown in Fig. 2, and a 2½″×1″ Double Angle Strip bolted to the top of the Plate carries a 3½″ Rod. Two 5½″ Angle Girders connected together by a Double Bracket are held in place on this Rod by Collars. Two 1″×1″ Angle Brackets are bolted to the rear end of the foot as shown. One carries a 3½″ Rod 17, while a Swivel Bearing 18 attached to the other by a ¾″ Bolt carries a Centre Fork 19, which is held against the ground by the Spring 20. A Flat Bracket 22, attached loosely by set-screws to the " spider " and boss of the Swivel Bearing, prevents excessive movement of the Centre Fork.

The 12½″ Angle Girders forming the upper parts of the legs are bolted to the 5½″ Angle Girders of the feet and the complete legs are pivoted by bolts and lock-nuts (see Standard Mechanism No. 262) immediately below the ¾″ Bolts holding the arms. The 3½″ Rod 17 is connected to an 11½″ Rod 20 by means of a Coupling, the whole being pivoted one inch to the rear of the leg pivot as follows: A bolt is passed through the Plate 1 and inserted in the set-screw hole of a Collar on the upper end of the Rod 20, and the bolt is screwed home until the Collar is fast on the Rod, leaving the bolt free to turn in the Plate. These Rods 20 ensure that the feet always remain parallel to the ground, to facilitate walking.

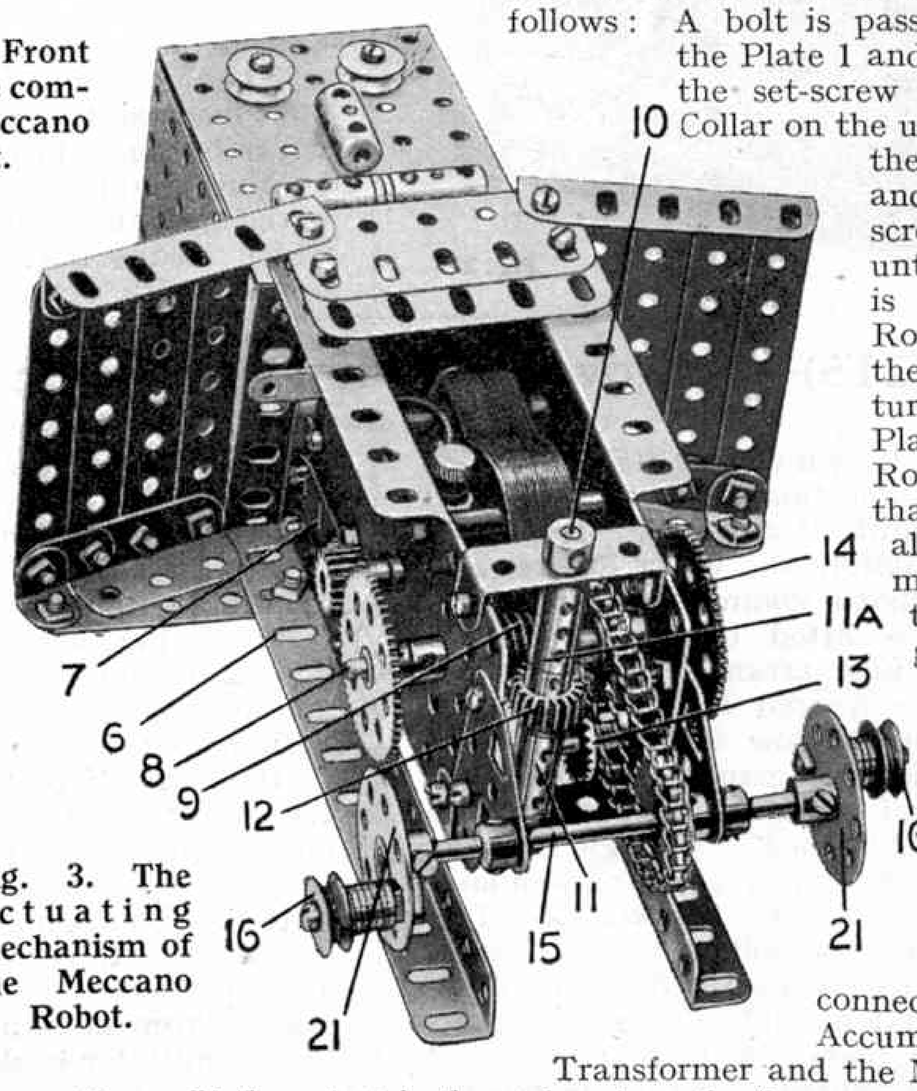


Fig. 3. The actuating mechanism of the Meccano Robot.

After the model has been completed the Motor terminals should be connected to an Accumulator or Transformer and the Motor set in motion. If the robot is then placed on the floor, or on a sheet of cardboard secured to the table top, it will " walk " slowly in any

direction, this remarkable movement being accompanied by the hum of the Motor and the whir of the gearing so that the complete effect is both startling and amusing.

In order to build the Meccano Robot the following parts will be required :—28 of No. 2 ; 10 of No. 3 ; 4 of No. 8 ; 2 of No. 8b ; 12 of No. 9 ; 3 of No. 9d ; 2 of No. 9f ; 12 of No. 10 ; 2 of No. 11 ; 3 of No. 12 ; 4 of No. 12a ; 2 of No. 13 ; 5 of No. 16 ; 3 of No. 16a ; 2 of No. 16b ; 1 of No. 17 ; 2 of No. 18b ; 2 of No. 20 ; 4 of No. 20a ; 2 of No. 22 ; 4 of No. 23 ; 2 of No. 24 ; 3 of No. 26 ; 2 of No. 27a ; 1 of No. 29 ; 1 of No. 32 ; 114 of No. 37 ; 15 of No. 37a ; 31 of No. 38 ; 2 of No. 43 ; 2 of No. 46 ; 1 of No. 48 ; 2 of No. 52 ; 4 of No. 52a ; 7 of No. 53 ; 1 of No. 53a ; 23 of No. 59 ; 8 of No. 63 ; 2 of No. 65 ; 2 of No. 70 ; 1 of No. 72 ; 6″ of No. 94 ; 1 of No. 96 ; 1 of No. 96a ; 2 of No. 103f ; 8 of No. 111 ; 4 of No. 111a ; 6 of No. 111c ; 2 of No. 126a ; 2 of No. 162a ; 2 of No. 165 ; 1 6-volt Electric Motor.

A Simple but Efficient Pit Head Winding Gear and Cage

The model Pit head Gear shown in Fig. 4 is sure to interest younger constructors, as it can be built with quite a small Outfit.

The base frame of the model consists of two pairs of 12½″ Angle Girders overlapped and bolted together so that they form 20″ girders. These built-up girders are held apart by means of 3½″ × ½″ Double Angle Strips. The cage shaft consists of two further pairs of 12½″ Girders and two 12½″ Strips secured in an upright position and held apart at the top by means of 5½″ Braced Girders and 3½″ × ½″ Double Angle Strips. A number of 12½″ Strips are used to brace the shaft to the base frame as can be seen in the illustration.

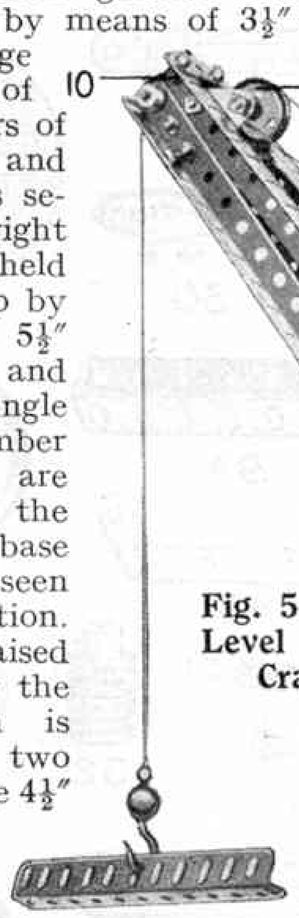


Fig. 5. Toplis Level Luffing Crane.

The cage is raised and lowered by the cord 1 which is wound between two 3″ Pulleys on the 4½″ Axle Rod 2. This Rod also carries a further 3″ Pulley which is provided with a Threaded Pin to form the operating handle, while a 5½″ Strip 3 secured by an Angle Bracket to the 5½″ × 2½″ Flanged Plate bears against the periphery of the Pulley and so serves as a brake. The Strip must be depressed slightly with the fingers whilst winding.

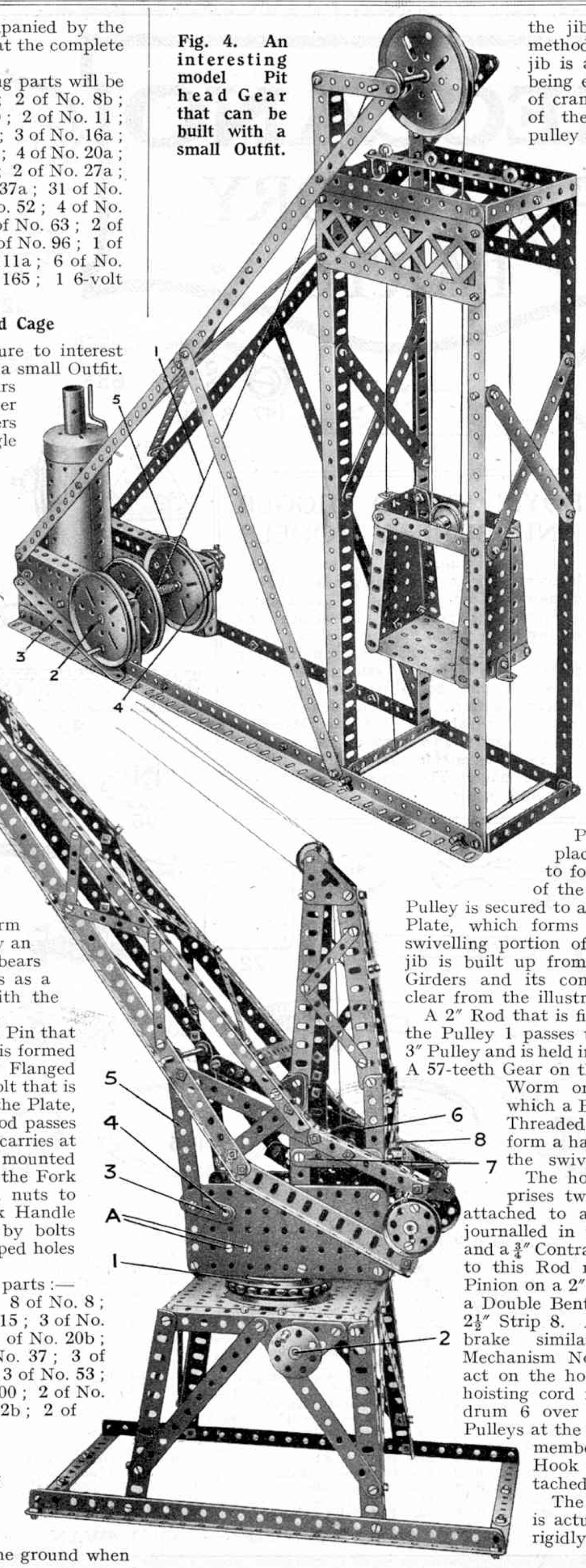
A Bush Wheel 4 on the Rod 2 carries a Threaded Pin that serves as the crank pin of a dummy engine, which is formed by a Sleeve Piece 5 fitted at each end with a ¾″ Flanged Wheel. The Sleeve Piece is mounted on a Pivot Bolt that is passed through its centre hole and lock-nutted to the Plate, being spaced from the latter by a Collar. A 2″ Rod passes through the boss of one of the Flanged Wheels and carries at one end a Swivel bearing, the " spider " of which is mounted loosely on the Threaded Pin. The bolts securing the Fork Piece to the " spider " should be provided with nuts to prevent their shanks gripping the Pin. A Crank Handle representing the exhaust steam pipe is secured by bolts passed through the Boiler, and inserted in the tapped holes of a Coupling and a Collar.

The model Pit head Gear comprises the following parts :— 10 of No. 1 ; 8 of No. 2 ; 4 of No. 3 ; 2 of No. 4 ; 8 of No. 8 ; 1 of No. 11 ; 14 of No. 12 ; 1 of No. 12a ; 1 of No. 15 ; 3 of No. 15a ; 2 of No. 17 ; 4 of No. 19b ; 1 of No. 19s ; 4 of No. 20b ; 1 of No. 22 ; 1 of No. 24 ; 4 of No. 35 ; 88 of No. 37 ; 3 of No. 38 ; 1 of No. 40 ; 2 of No. 48b ; 2 of No. 52 ; 3 of No. 53 ; 2 of No. 54 ; 4 of No. 59 ; 1 of No. 63 ; 2 of No. 100 ; 2 of No. 115 ; 1 of No. 147b ; 1 of No. 162a ; 1 of No. 162b ; 2 of No. 163 ; 1 of No. 164 ; 1 of No. 165.

Level Luffing Crane

The Level Luffing Crane, shown in Fig. 5 is of particularly novel design. The crane is of the " level luffing " type, the hoist motion being coupled to the luffing gear in such a way that the load is suspended at a constant height from the ground when the jib is luffed. The method of luffing the jib is also unusual, this being effected by means of crank action in place of the more common pulley and drum system.

Fig. 4. An interesting model Pit head Gear that can be built with a small Outfit.



The construction of the model should be commenced by building the base frame. This as will be seen from Fig. 5 consists of two 12½″ Angle Girders spaced apart by two pairs of 5½″ Strips. The platform mounted upon this frame is composed of 5½″ Angle Girders and two 5½″ × 2½″ Flanged Plates. A 3″ Pulley Wheel is secured to these latter Plates to form the lower half of the ball race and a Wheel Flange is bolted to the Pulley. Twenty Meccano Steel Balls should then be placed in the groove formed by the Pulley rim and Wheel Flange and a second 3″ Pulley 1 should be placed on top of these to form the upper half of the race. This latter Pulley is secured to a 5½″ × 2½″ Flanged Plate, which forms the base of the swivelling portion of the crane. The jib is built up from four 24½″ Angle Girders and its construction will be clear from the illustration.

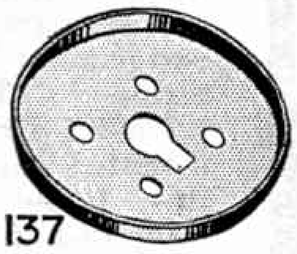
A 2″ Rod that is fixed in the boss of the Pulley 1 passes through the lower 3″ Pulley and is held in place by a Collar. A 57-teeth Gear on this Rod engages a Worm on the Rod 2, on which a Bush Wheel with a Threaded Pin is fixed to form a handle for operating the swivelling movement.

The hoisting drum comprises two Bush Wheels 6 attached to a 3″ Rod that is journalled in two 2½″ Strips 7, and a ¾″ Contrate Wheel attached to this Rod meshes with a ½″ Pinion on a 2″ Rod journalled in a Double Bent Strip and in the 2½″ Strip 8. A strap and lever brake similar to Standard Mechanism No. 81 is fitted to act on the hoisting shaft. The hoisting cord is taken from the drum 6 over one of the loose Pulleys at the top of the vertical member, and the Crane Hook may now be attached to the cord.

The luffing movement is actuated by Cranks 3 rigidly attached to the

(*Continued on page 77*)

MECCANO ACCESSORY PARTS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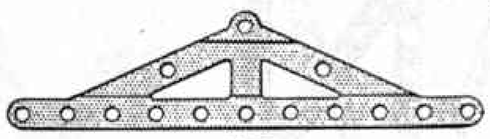
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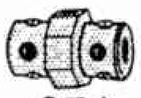
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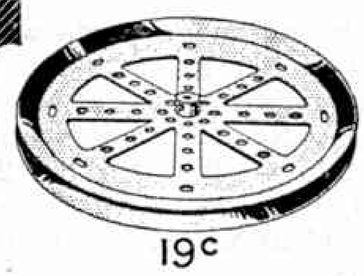
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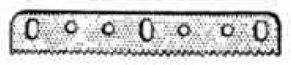
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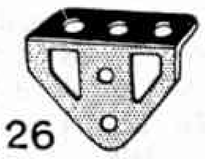
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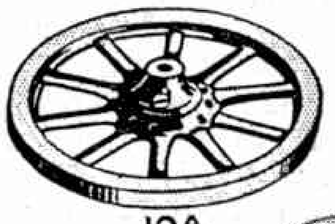
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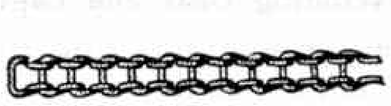
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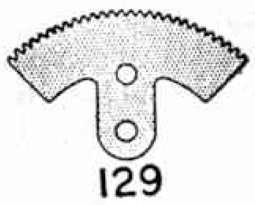
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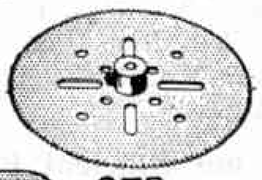
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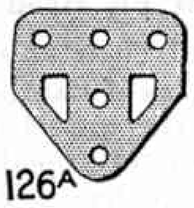
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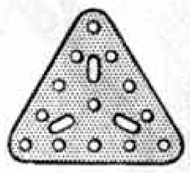
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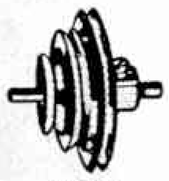
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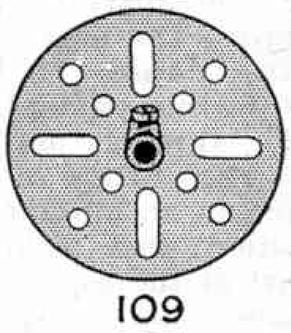
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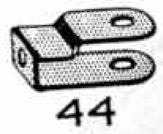
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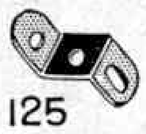
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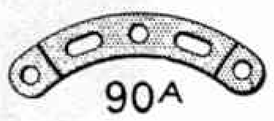
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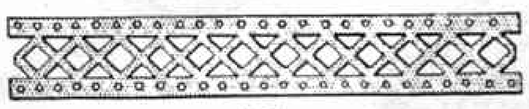
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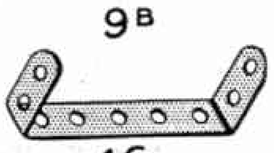
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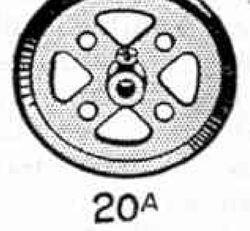
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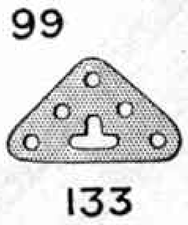
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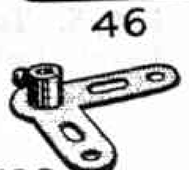
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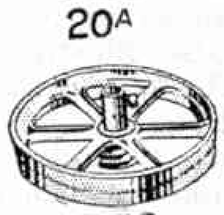
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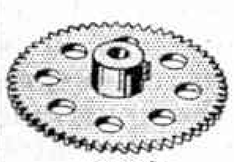
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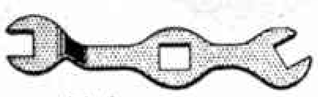
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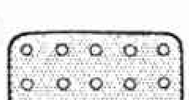
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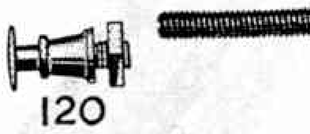
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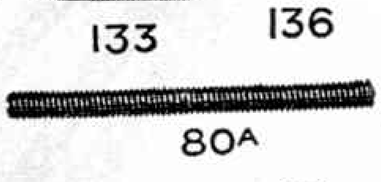
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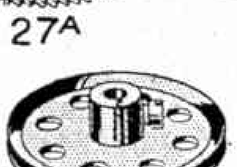
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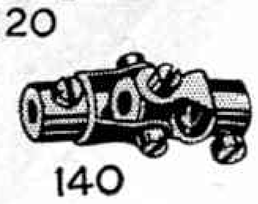
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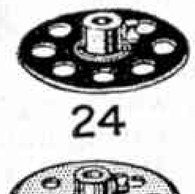
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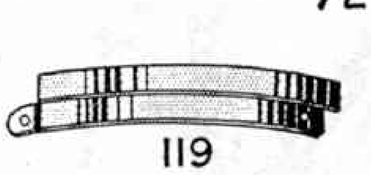
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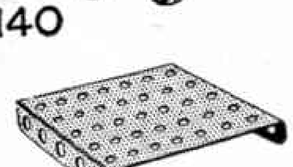
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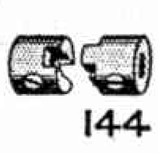
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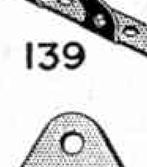
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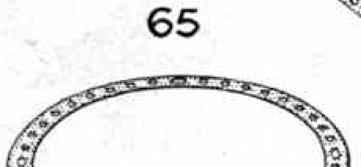
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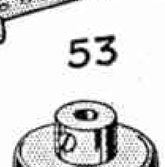
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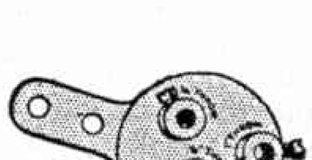
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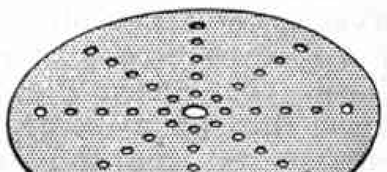
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BOYS! BUILD BIGGER AND BETTER MODELS

It is the ambition of every keen Meccano boy to build bigger and better models. That is why he constantly increases the scope of his Outfit by adding more parts.

There are over 250 real engineering parts in the Meccano system, every one of which can be obtained from any Meccano dealer. Ask your dealer for a complete illustrated list of Meccano parts, or write direct to us for a copy.

A selection of Meccano parts is shown on this page. The prices of these are indicated below.

No.		s.	d.
3.	Perforated Strips, 3½" long ... ... ½ doz	0	4
9b.	Angle Girders, 3½" long „	0	8
17.	Axle Rods, 2" long ... 3 for	0	1
19a.	Wheels, 3" diam., with set screws ... ... each	0	6
20.	Flanged Wheels, 1⅛" diam. „	0	5
	Pulley Wheels with centre boss and set screw:		
19b.	3" diam. ... ... each	0	7
19c.	6" „ ... ... „	2	0
20a.	2" „ ... ... „	0	5
21.	1½" „ ... ... „	0	4
22.	1" „ ... ... „	0	3
23a.	½" „ ... ... „	0	3
	Pulley Wheels without centre boss and set screw:		
22a.	1" diam. ... ... each	0	2
23.	½" „ ... ... „	0	2
24.	Bush Wheels ... ... „	0	4
27a.	Gear Wheels, 57 teeth to gear with ½" pinion... „	0	6
27b.	Gear Wheels, 133 teeth to gear with ½" pinion (3½" diam.) ... ... each	1	3
28.	Contrate Wheels, 1½" diam. „	0	9
29.	„ „ ¾" „	0	6
30.	Bevel Gears, ⅞", 26 teeth „	0	9
31.	Gear Wheels, 1", 38 teeth „	1	0
32.	Worm Wheels ... ... „	0	5
34.	Spanners ... ... „	0	2
44.	Cranked Bent Strips ... „	0	1
45.	Double „ „ ... „	0	1
46.	Double Angle Strips, 2½" × 1" ... ... ½ doz.	0	6
53.	Perforated Flanged Plates, 3½" × 2½" ... each	0	3
55.	Perforated Strips, slotted, 5½" long ... ... „	0	2
57b.	Hooks, Loaded ... ... „	0	3
63a.	Octagonal Couplings ... „	0	8
63b.	Strip Couplings ... ... „	0	8
65.	Centre Forks ... ... „	0	1
72.	Flat Plates, 2½" × 2½" ... „	0	2
76.	Triangular Plates, 2½" each	0	2
77.	„ „ 1" „	0	1
80a.	Screwed Rods, 3½" ... „	0	3
90a.	2½" Curved Strips, cranked, 1⅜" radius, 4 to circle „	0	1
94.	Sprocket Chain, per 40" length	0	6
95.	Sprocket Wheels, 36 teeth, 2" diam. ... ... each	0	5
95b.	Sprocket Wheels, 56 teeth, 3" diam. ... ... each	0	6
99.	Braced Girders, 12½" long ½ doz.	2	6
103d.	Flat Girders, 3½" long „	0	7
109.	Face Plates, 2½" diam. each	0	4
110.	Rack Strips, 3½" ... „	0	2
113.	Girder Frames ... ... „	0	3
116.	Fork Pieces, Large ... „	0	3
118.	Hub Discs, 5½" diam. „	1	3
119.	Channel Segments (8 to circle, 11½" diam.) .... „	0	4
120.	Buffers ... ... „	0	2
123.	Cone Pulleys ... ... „	1	3
125.	Reversed Angle Brackets, ½" ... ... ½ doz.	0	3
126.	Trunnions ... ... each	0	2
126a.	Flat Trunnions ... ... „	0	1
128.	Boss Bell Cranks ... „	0	3
129.	Rack Segments, 3" diam. „	0	5
130.	Eccentrics, Triple Throw „	1	0
132.	Flywheels, 2¾" diam. „	2	0
133.	Corner Brackets ... „	0	1
136.	Handrail Supports ... „	0	3
137.	Wheel Flanges ... ... „	0	3
139.	Flanged Brackets (right) „	0	2
140.	Universal Couplings ... „	0	10
143.	Circular Girders, 5½" diam. ... ... „	1	0
144.	Dog Clutches ... ... „	0	6
145.	Circular Strips, 7½" diam. over all ... ... „	0	9
146.	Circular Plates, 6" diam. „	1	0
147.	Pawls, with pivot bolt and nuts ... ... „	0	3
148.	Ratchet Wheels ... „	0	6

MECCANO LIMITED — OLD SWAN — LIVERPOOL

Great Opportunity for Model-Builders

£36 in Prizes for Meccano Models

A Contest for Owners of No. 000 and No. 3 Outfits

The competition announced on this page is the first of a series of "Outfits" Contests that we propose to run during the next few months. All the contests will be arranged on similar lines, with the exception that the sizes of Outfits involved will be changed each month. In this manner the opportunity of competing will be extended to all readers of the "*M.M.*," no matter what size of outfit they possess. Each contest will be complete in itself.

This month prizes are offered for the "Best Models Made Entirely from Either a No. 000 Outfit or a No. 3 Outfit." Readers who possess larger outfits may of course enter, provided that they use only parts that are found in either the No. 000 or No. 3 Outfits. For the benefit of those who are not familiar with the contents of these two outfits we give below lists of the parts in each. It is, of course, not necessary to use all the parts contained in the outfit.

Entries will be divided into four Sections as follows: Section A, for models built from No. 000 Outfits by competitors living in the British Isles; Section B, for models built from No. 3 Outfits by competitors living in the British Isles. Section C, for models built from No. 000 Outfits by competitors living Overseas; Section D, for models built from No. 3 Outfits by competitors living Overseas.

Each Section is open to readers of all ages, and competitors may submit both a No. 000 model and a No. 3 Outfit model if they wish; but no competitor may win more than one prize.

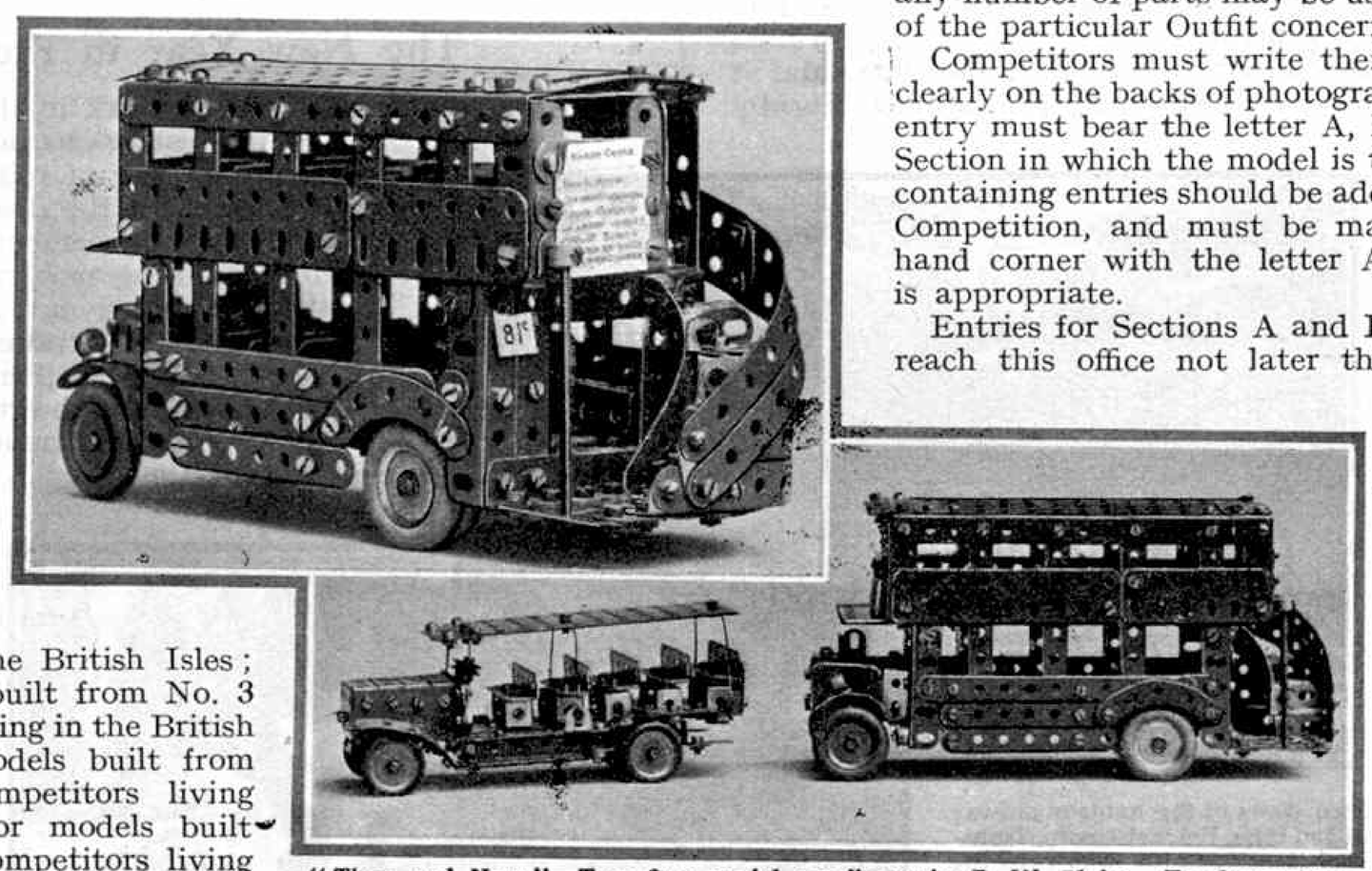
The following prizes will be awarded in each of the Sections A and C:—First Prize, Meccano goods value £2-2s.; Second Prize, Meccano goods value £1-1s.; Third Prize, Meccano goods value 10/6; and Twelve Prizes each consisting of a range of Meccano parts to convert a No. 000 Outfit into a No. 0 Outfit.

The following prizes will be awarded in each of the Sections B and D:—First Prize, Cheque for £2-2s.; Second Prize, Cheque for £1-1s.; Third Prize, Cheque for 10/6; Twelve Prizes each consisting of Meccano goods to value 5/–; and Six Prizes each consisting of a Meccano Engineer's Pocket Book. In addition a number of Certificates of Merit will be awarded for models that are considered by the judges to be next in order of merit.

It is only necessary to send either a photograph, or a drawing of the model. Actual models must not be sent. Competitors must enclose with their entry a complete list of the Meccano parts contained in the model. Any type of model may be submitted, and any number of parts may be used so long as the contents of the particular Outfit concerned is not exceeded.

Competitors must write their age, name and address clearly on the backs of photographs or drawings, and each entry must bear the letter A, B, C, or D, indicating the Section in which the model is to be entered. Envelopes containing entries should be addressed January "Outfit" Competition, and must be marked in the bottom left-hand corner with the letter A, B, C, or D, whichever is appropriate.

Entries for Sections A and B must be posted so as to reach this office not later than 28th February, 1931. Entries for Sections C and D (Overseas) must reach this office not later than 30th May, 1931.



"Then and Now."—Two fine model omnibuses by R. W. Blake. The lower illustration shows a bus of years gone by, together with one of London's latest type, which is shown more clearly in the upper illustration. These models won a prize in the "Autumn" Model-building Contest, 1929.

The following is a complete list of the parts contained in the No. 000 Outfit:

2 of No. 2; 2 of No. 5; 2 of No. 10; 4 of No. 12; 2 of No. 16; 1 of No. 17; 4 of No. 22a; 4 of No. 35; 12 of No. 37; 1 of No. 40; 2 of No. 48a; 1 of No 52; 1 of No. 126.

The contents of the No. 3 Outfit are as follows:

10 of No. 1; 18 of No. 2; 6 of No. 3; 2 of No. 4; 12 of No. 5; 2 of No. 6a; 8 of No. 8; 8 of No. 10; 4 of No. 11; 14 of No. 12; 4 of No. 12a; 1 of No. 13; 2 of No 15; 3 of No. 15a; 4 of No. 16; 2 of No. 17; 4 of No. 18a; 1 of No. 19; 1 of No. 19s; 4 of No 19b; 2 of No. 20a; 4 of No. 20b; 1 of No. 21; 4 of No. 22; 2 of No. 22a; 1 of No. 23; 1 of No. 24; 2 of No. 26; 1 of No. 27a; 1 of No. 32; 1 of No. 34; 14 of No. 35; 1 of No. 36; 94 of No. 37; 6 of No 37a; 14 of No. 38; 3 of No. 40; 1 of No. 43; 1 of No. 44; 2 of No. 45; 1 of No. 46; 2 of No. 48; 10 of No. 48a; 2 of No. 48b; 2 of No. 52; 3 of No. 53; 2 of No. 54; 1 of No. 56a; 1 of No. 56c; 1 of No. 57; 4 of No. 59; 2 of No. 62; 1 of No 63; 2 of No. 90; 4 of No. 90a; 1 of No 98; 2 of No. 99; 2 of No. 100; 2 of No. 111; 6 of No. 111c; 2 of No. 115; 1 of No. 116; 1 of No. 116a; 4 of No. 125; 2 of No. 126; 2 of No. 126a; 1 of No. 147b; 1 of No. 162; 2 of No. 163; 1 of No. 164; 1 of No. 165; 1 of No. 166.

Meccano "Ships" Model-Building Competition

This competition offers a wide scope to readers, for the subject on which models are required to be designed is a "ship." This term is intended to include passenger liners, cargo vessels, warships, tug boats, fishing trawlers, steam yachts, etc., and it includes also vessels such as life-boats, motor boats, and submarines.

Competitors may build their models from any size of Outfit or number of parts.

Entries will be divided into two Sections:—Section A, for readers of all ages living in the British Isles; Section B, for readers of all ages living Overseas. Each competitor's age will be considered when judging the entries.

We believe that many Meccano boys are deterred from entering model-building contests by the thought that the chances are greatly in favour of the owners of large outfits; in other words, that the more parts a competition model contains, the better its chance of securing an award. This is a great mistake. Each entry is considered on its merits as a model, entirely apart from its size or complexity. The result is that each entrant, no matter what the size of his outfit may be, has exactly the same chance of success as any other competitor.

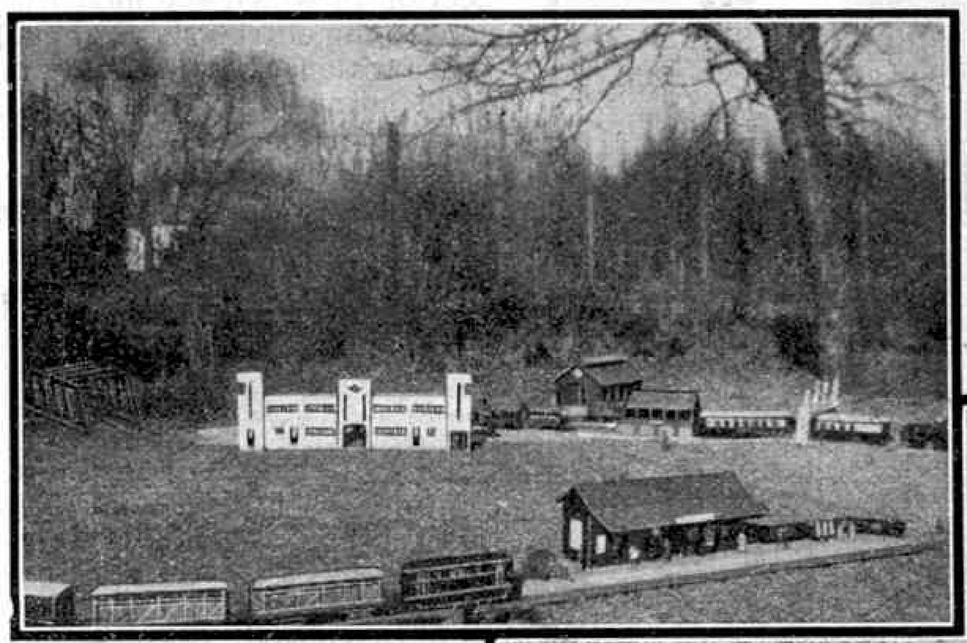
Actual models must not be sent. A clear photograph or a good drawing is all that is necessary. If there are any points of special interest in the model that are not clearly shown in the photograph or drawing, a written explanation should accompany the entry. The competitor's age, name and address must be written on the back of each photograph or drawing sent, together with the letter A or B indicating the Section in which the model is entered. Envelopes should be addressed to Meccano "Ships" Contest, Meccano Ltd., Old Swan, Liverpool. **Closing Dates:** for Section A, 28th February, 1931. Overseas Section, 30th May, 1931.

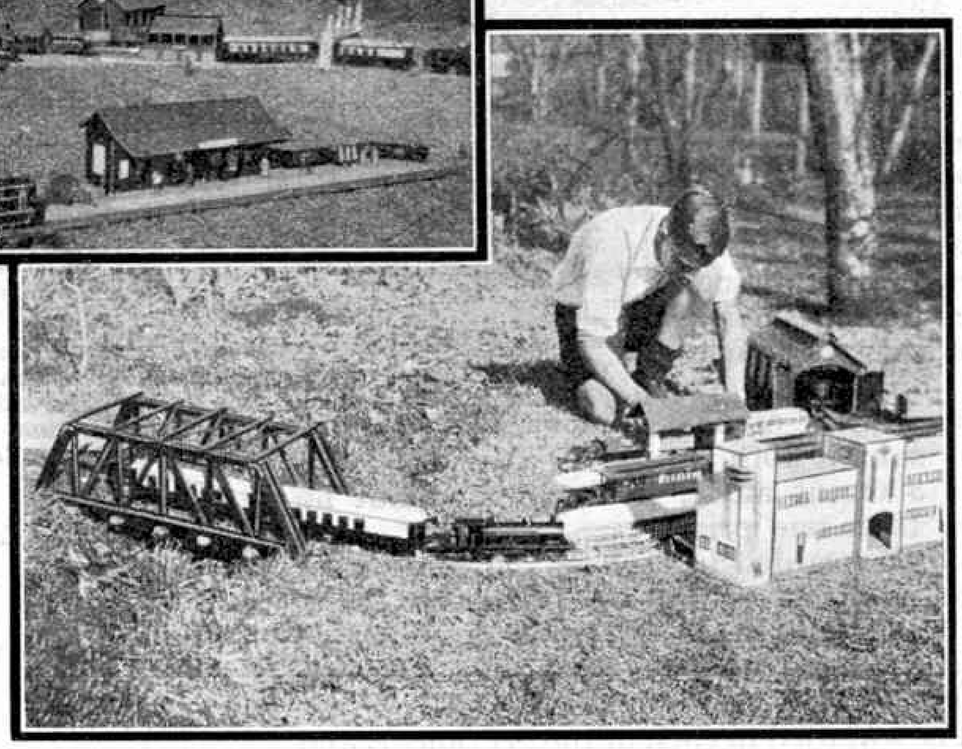
The following prizes will be awarded for the best entries from each Section:—First Prize, Meccano or Hornby Train goods value £2-2s. Second Prize, Meccano or Hornby Train goods value £1-1s. Third Prize, Meccano or Hornby Train goods value 10/6. Six Prizes of Meccano or Hornby Train goods value 5/–. Six Prizes, each consisting of a copy of "Famous Trains" by Mr. C. J. Allen. Twelve Meccano Certificates of Merit will be awarded also in each Section.

New Year Greetings

"A Happy New Year" to all members of the Hornby Railway Company and of local Branches in all parts of the world. I feel that I must also include in this greeting the parents and grown-up friends of the members, for there are very few cases in which they do not show their interest in miniature railways, and in the progress of the H.R.C. generally. It is very curious to note how their interest increases about this time of the year, and it is now an old joke that the proud owner of a brand-new Hornby Train Set has very few opportunities of running his train until father's holidays have ended! I am sure that every member of the H.R.C. will meet such a situation in a kindly spirit.

It is a source of gratification to find that this year I am able to send good wishes to practically twice as many Hornby Train enthusiasts as last year, for the number of members now exceeds 20,000, while a year ago it was 11,000. The Hornby Railway Company was founded as recently as October, 1928, and is therefore very little more than two years old; but in a remarkably short time it attained a unique position and is now recognised as the greatest association of miniature railway enthusiasts in the world. I am convinced that 1931 will strengthen the Company's position even further, and I am looking forward to another record increase in numbers during the year. This can be achieved without difficulty if every member determines to do his best to introduce his friends to the pleasures enjoyed by those who have already joined.





Two views of the outdoor railway of Jan Hers, Potchefstroom, Transvaal (H.R.C. 8270), who runs the interesting "See the World" Tourist Office mentioned on page 638 of the "M.M." for August, 1930.

The increase in the number of members of the H.R.C. is not the only sign of the growing popularity of the movement. It is even more satisfactory to note the great increase in the bulk of the correspondence that daily passes through Headquarters, for this shows that the interest of members is really active. Every Hornby Train owner who has joined the H.R.C., no matter what his age or the extent of his layout, is entitled to ask for advice and assistance, and we at Headquarters pride ourselves on our readiness and ability to deal with every problem sent for our consideration.

A Word to New Members

At this time of the year boys in all parts of the world are introduced for the first time to the delights of running Hornby Trains, and the first thing many of them do is to join the H.R.C. I wish these new members to realise that at the Headquarters of the Company are a number of enthusiastic model railway experts, whose only desire is to help them to get more fun from their trains. Therefore I urge all new members to write to me as often as possible and to keep in constant touch with me. They will gain largely from correspondence of this kind, for the staff of the H.R.C. are thoroughly familiar with real railways as well as with those run on a miniature scale, and are able to give much useful information. Their interest is not confined to railway matters only, however, and they are always delighted to hear something of the lives of the great army of members with whom they are in correspondence, and to help them with advice on a great variety of subjects.

The New Year in the Branches

During the present month work in the Branches should be of a very interesting character. At this time of the year the amount of rolling stock and other railway material at the disposal of members usually is increased and members are busy forming plans for incorporating new rails, points and crossings in the Branch layout and in devising schemes for running more trains and introducing others of special character. Friendly discussions between the members under the guidance of their Chairmen, or of the officials appointed to superintend the running of the Branch model railway, may be relied upon to produce satisfactory schemes, and I hope that as soon as plans for the coming session have been settled, full details will be forwarded to Headquarters. The expert members of the staff will examine them with interest, and they may be able to point out more realistic ways of signalling the track, or to suggest other little alterations or additions, that will greatly increase the scope of operations without interfering with the aims and desires of the members themselves.

When the new track has been completed, and new locomotives and rolling stock have been carefully run in, many enjoyable evenings will be spent on operations of a more interesting character than ever. This I hope will be reflected in the reports forwarded to Headquarters. A typical member of the H.R.C. is always willing to share good things with his fellow enthusiasts, and new schemes that have increased enjoyment in one Branch are almost certain to have a similar effect in another. The great medium of exchange of ideas of this kind is the "Branch Notes" page of the "*M.M.*", which is the official organ of the H.R.C. Secretaries therefore should lose no time in forwarding accounts of interesting work, or of useful innovations in Branch proceedings, in order that they may help their friends in other Branches to get the greatest enjoyment from their hobby.

In planning the programme for the coming session, special attention should be paid to the possibility of holding an Exhibition, or an Open Night, when parents and friends of the members may be invited to inspect the Branch layout and to watch operations being carried out on it. These functions usually are held towards the end of the session, but it is by no means too soon to consider the attractions that will be presented and a large part of the work of track building and extension should be undertaken for the purpose of making a layout that will be attractive to visitors. Early preparation is particularly necessary if the programme is to include a Concert in addition to demonstrations on a model railway.

Branch Notes

FIRST EDINBURGH.—The Leader of St. George's Meccano Club has very kindly presented the Branch with a large quantity of points and track, and the father of a member has given a scale model of a suburban station, complete with signal box and signals. Visits have been paid to the Haymarket and St. Margaret's Engine Sheds. The "Pacifics" that work the East Coast route expresses were seen at Haymarket. At St. Margaret's members were allowed to enter the firebox of an "Atlantic," and to turn the engines in the round house. A breakdown crane was seen at work lifting an old "Metropolitan" tank to allow the wheels to be removed. Regular visits are paid to the Waverley and Princes St. Stations, and on an excursion to Leith Docks the L.M.S. shunting engines illustrated on p. 487 of the June "*M.M.*" were seen at work. Secretary: John A. Gower, "Fairhaven," Russell Place, Trinity, Edinburgh.

COLET COURT SCHOOL.—Great attention is at present being paid to the signalling of the track. Double track has been installed throughout and the number of sidings increased. As many as 17 engines and 24 coaches may now be employed on the track at one time. Electric torches have been fixed over the sidings to represent arc lamps and night operations under the light they give have been very successful. The use of the Branch colour light signals gives a very realistic appearance to the track. Secretary: D. J. Higgens, 28, Hillersdon Avenue, Barnes, S.W.13.

ASHLEIGH (BEXLEY).—An experimental two-phase colour light signal has been given a thorough trial. It worked so efficiently that the system is being introduced on the parts of the Branch layout not already fitted with the signals of the semaphore type. Secretary: A. F. C. Harmer, "Ashleigh," Manor Way, Bexley, Kent.

COLWYN BAY.—Express goods traffic and shunting operations have been regularly carried out to timetable and a passenger service has been established. A meeting was held to discuss improvements to the track. One suggestion made was that on the electric track, goods yard work should be carried on by clockwork engines and this was adopted. An Exhibition is to be held next month. Secretary: Mrs. Jones, "Granville," Woodland Road, Colwyn Bay.

SWANSEA.—An interesting visit was paid to the Landore Engine Sheds and the members were allowed to inspect the cabs of many well-known types of locomotives. The working of a new coal charger and water tank was explained. The Branch exhibited a working model railway at a "Maritime Fair" held by the "Mission to Seamen." The layout included a model dock with Meccano ships in real water, cranes and dockside appliances. Keen interest was taken in the two 4–4–2 Hornby Electric locomotives that hauled realistic loads, and the track was surrounded by interested visitors during the whole of the three nights of the exhibition. Secretary: L. T. Levitt, "Alpha House," Townhill Road, Sketty, Swansea.

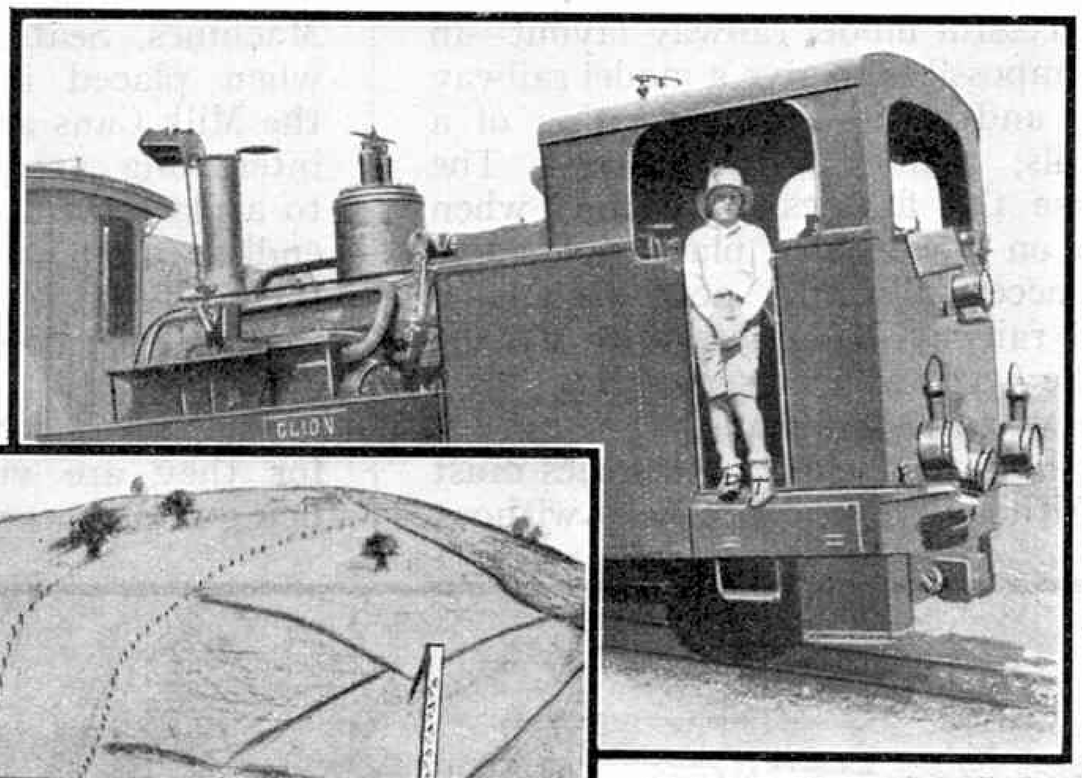
ST. JOHN'S SCHOOL (LEATHERHEAD).—The Branch now possesses a good club room, in which the track has been permanently laid. At the first meeting held in the new room several serious crashes took place owing to the inefficiency of the signalmen! Practice and the determination of members to make themselves familiar with regulations has remedied this state of affairs, and the number of accidents has been considerably reduced. Secretary: T. Barfett, Halsetown Vicarage, St. Ives, Cornwall.

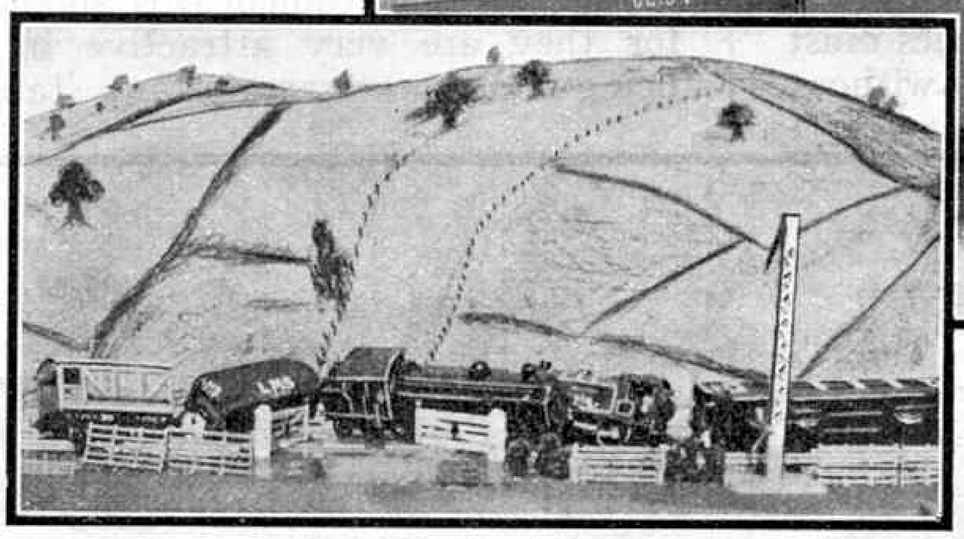
WEST KENT.—Two meetings during the month were devoted to extensive alterations on the Branch track and greatly improved operation has been the result. In an attractive competition entrants were required to answer a series of railway questions. Members showed a creditable knowledge of railway affairs, and in a keen contest the prize was shared by two of the competitors. Secretary: F. R. Dubery, 48, Reddons Road, Beckenham, Kent.

READING SCHOOL.—Interesting discussions of various railway matters have figured prominently on the programme. "*Electricity of the Future*," "*Railways of Switzerland*," "*The Great Western Railway*," and "*Railways in Miniature*" are typical subjects that have been discussed. Track work also has been carried out and very satisfactory working efficiency has been attained. Secretary: John C. Rivett, West Wing House, Reading School, Reading.

WHITSTABLE.—The Branch has been allowed the use of a large loft as a club-room and a semi-continuous track has been laid down on shelves. The layout represents the London-Ramsgate line of the S.R., and in addition to the two termini, "Margate" and "Faversham" stations have been built. Secretary: L. C. C. Armstrong, 50, Acton Road, Whitstable, Kent.

HAROLD WOOD.—The Branch now meets in a large attic in a member's house. Trestles have been obtained and the track is being laid permanently. As a relaxation a games meeting was held. An exciting debate has taken place on the question "*Which British Railway possesses the most efficient Locomotives?*" Secretary: C. L. Barber, "Beaurains," Church Road, Harold Wood.





(Above) R. W. Bentley, Minehead (H.R.C. No. 1430) on the footplate of a Swiss mountain railway locomotive. (Left) A terrible disaster at a level crossing on the very realistic layout of Peter Hunt, Birmingham (H.R.C. No. 15718).

OVERSEAS

WESTRALIAN—The Branch made its first public appearance by giving a two-day demonstration at the State Annual Flower Show. On a track representing the G.W.R. line from Paddington to Cardiff, 13 locomotives, 12 Pullman coaches and about 50 goods wagons of various types were in continuous service for six hours on both days. All the signals were electrically operated, and the scenic effects, booking hall, passengers, porters, luggage and milk churns made an attractive show that aroused great interest. In addition, 100 coloured plates of English trains and locomotives were exhibited. Secretary: Mr. S. H. Chittenden, 31, Venn Street, Perth, Western Australia.

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promotors, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

BRENTWOOD—P. L. Venner, 51, Western Road, Brentwood, Essex.

FALKIRK—I. W. Williamson, The Manse, Old Polmont, Falkirk.

HARROGATE—E. Bottomley, 5, Regent Parade, Harrogate.

HIGHBURY—R. Post, St. John's Hall, Highbury, London, N.

KENDAL—R. O. Alnwick, Grayrigg Vicarage, Kendal.

LARBERT—Norman Reid, 28, Stewartfield Place, Larbert, Stirlingshire.

LEICESTER—W. Francks, "Avoncroft," Guilford Road, Leicester.

NEWCASTLE—E. M. Page, 10, Water Street, Newcastle, Staffs.

NORWICH—A. J. Eagle, 36, Bethel Street, Norwich.

PERTH—Mr. W. Boyes, Stormont Cottage, Stormont Street, Perth.

PRESTON—Charles Norman, 7, Paradise Street, Preston, Lancs.

SWINDON—W. Cowlishaw, 18, Holbrook Street, Swindon, Wilts.

WALLASEY—J. Wylde, 3, Withington Road, Wallasey, Cheshire.

WEAVERHAM—N. Clarke, 8, Church View, Weaverham, Cheshire.

WHITTINGTON—J. F. Grindley, Kepler Cottage, Whittington, Nr. Oswestry, Shropshire.

Further H.R.C. Incorporated Branches

150. BANBURY HORNETS—Geoffrey White, Bridge Street, Banbury.

151. WESTON-SUPER-MARE—C. E. Hyssett, "Bayonne," 6, Elmhyrst Road, Weston-super-Mare.

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

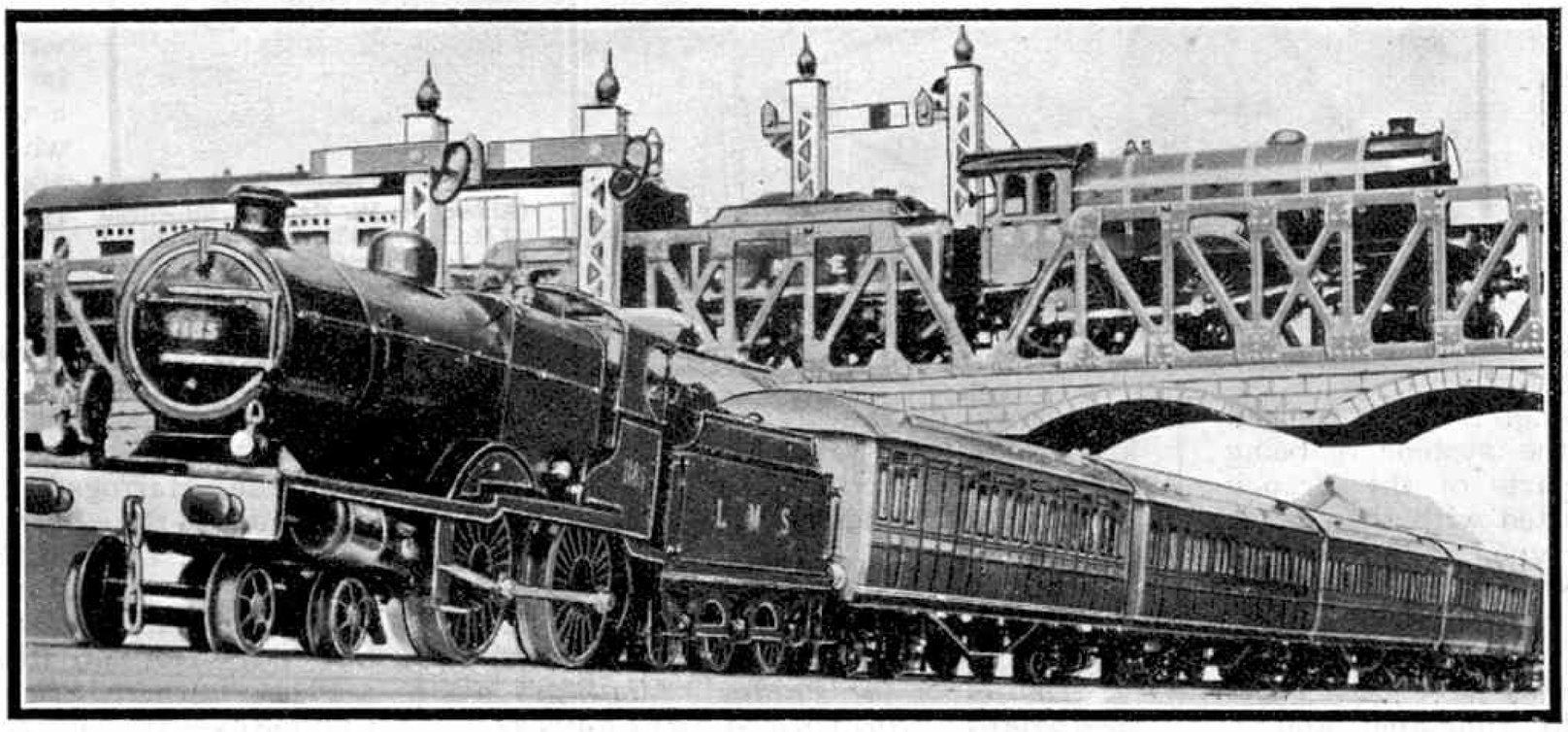
JUNIOR SECTION

XXV.—The Placing of Accessories

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

ONE of the great features of the Hornby Railway System is the large number of accessories included in it. Accessories play a very important part in the production of a successful model railway layout—in fact without them it is impossible to give a model railway a realistic appearance, and avoid any suggestion of a mere collection of rails, points and crossings. The track itself is of course the first essential, but when it has been laid down on a workable plan, and trains are running over it successfully, the next step is to give the layout a real railway-like appearance by the gradual addition of the various accessories that form so interesting a feature of actual railways.

In order to produce the proper effect accessories must be placed correctly. Although a model railway without accessories can never look realistic, it is greatly to be preferred to one that is crowded with accessories dumped down anyhow and anywhere, and without regard to the part they play in actual railway practice. A few accessories skilfully placed look far better than a large number without systematic arrangement or due regard to purpose.



A novel temporary bridge made up of centre sections of the Hornby Viaduct placed end to end. To make the idea perfectly clear the right-hand arch is shown unsupported. The best support is a box girder built of four 5½″ vertical Angle Girders fastened together top and bottom by 1½″ Strips and cross-braced with 2″ Strips.

There are of course some accessories, such for instance as buffer stops, that look after themselves, for they cannot very well be placed in wrong positions. There are two types of buffer stops in the Hornby Series, the ordinary spring type that can be used for all general purposes for goods and passenger lines alike; and the larger hydraulic type, which are intended specially for important station terminals. These hydraulic-type buffers are very pleasing in appearance and add a surprising touch of realism to any model terminal station.

All too often one sees station platforms empty and bare, looking as though some sudden disaster had swept away all traces of human activity! This deserted appearance may be avoided easily by the placing in suitable positions of some of the Hornby platform accessories. The Miniature Luggage and Truck placed towards the end of the platform, where the luggage van would be likely to stop, look very effective. They may be either left permanently on the platform, or loaded into the van and carried to another station. The miscellaneous small accessories, such as Platform Machines, Seats, Letter Box, etc., are very attractive when placed in suitable positions. Then there are the Milk Cans and Trucks. These cans are particularly interesting accessories. They not only give "life" to a platform upon which they stand, but they provide endless fun in loading them into Milk Vans and conveying them by rail just as is done on real railways. A train composed entirely of Milk Vans looks very effective.

The Station Nameboards should not be overlooked, for they are very attractive in appearance, besides being really necessary for any station.

The Hornby single or double Lamp Standards are very interesting accessories, especially if an electric flashlamp bulb is fitted into the globe and connected by wires to a dry battery or accumulator. A model station lighted by two or more of these standards is very fascinating in appearance. It is often possible to improve the lighting effect by raising or lowering the lamps by means of the crank handle fitted at the base of the standard and controlled by a ratchet. The best flashlamps to use are those of the flat pattern, for these fit most neatly inside the globe. The connections should be made by means of thin "flex," and it will be found easy to secure good connections without any soldering by twisting the bared ends of the wire to the lamp holder and screw respectively. Readers who find any difficulty in lighting their stations in this manner should write to H.R.C. Headquarters, stating just where they have been unsuccessful.

The Lattice Girder Footbridge looks well placed towards one end of a terminal station to enable passengers to cross from one platform to another. It is also very effective for a country station, for the use of passengers who wish to cross the line.

The Turntable, which is such an important feature

of railway equipment, should be within easy reach of a terminal station. The best position for it is on a siding just beyond the station, that will allow engines to run direct to it from the platform. If the station layout includes a series of sidings, it is important that matters should be arranged so that an engine on any one of these sidings should be able to reach the turntable without difficulty. A water tank may be placed just beyond the turntable.

The Engine Shed is a particularly realistic accessory, being beautifully finished in correct colours, and in every respect a fine model. The position in which this shed is placed is dependent to some extent upon the space available, but perhaps the most convenient position is on a siding leading from the turntable.

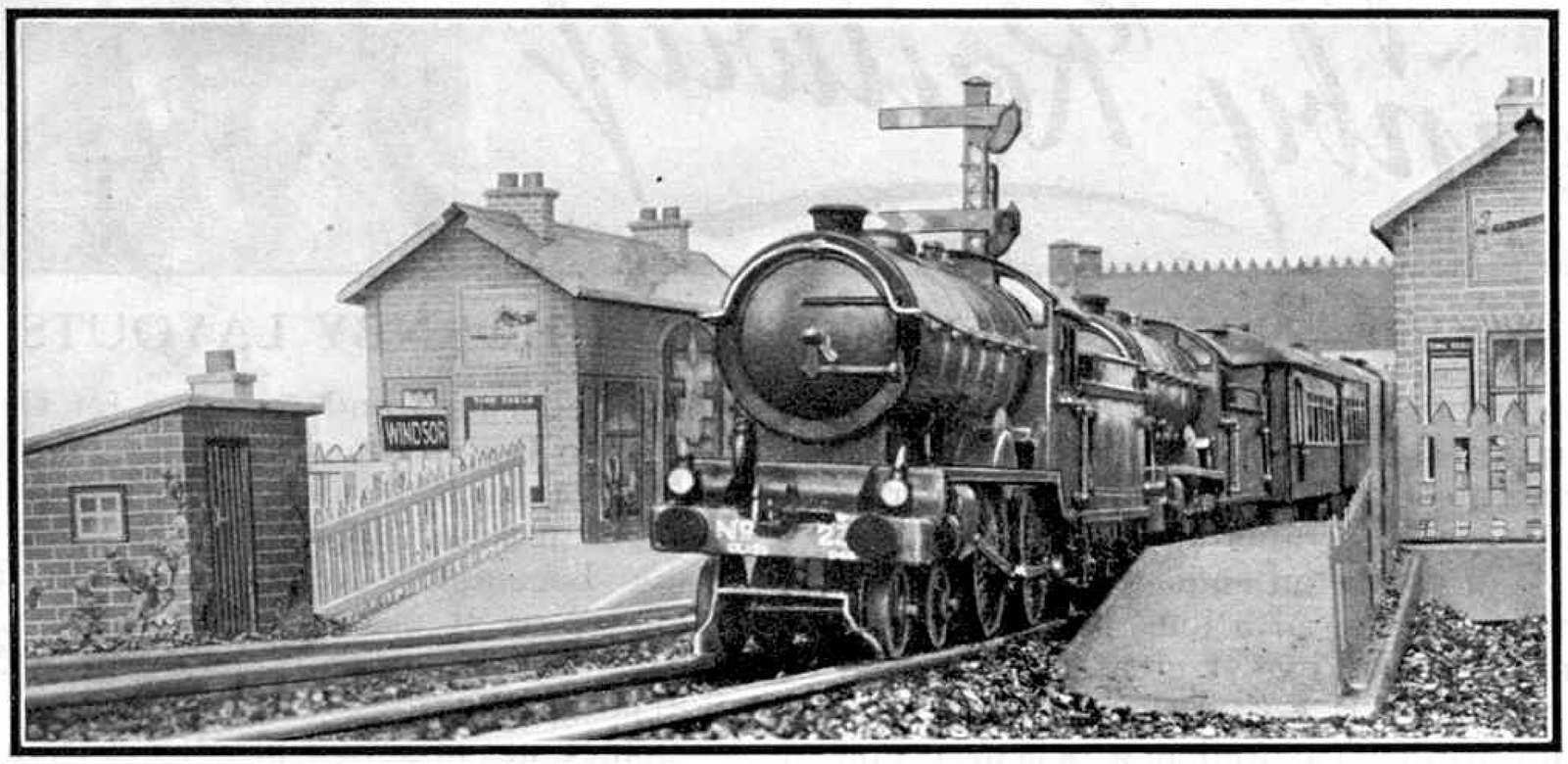
The Loading Gauge should be where all goods wagons proceeding to the main line from sidings must pass beneath it.

The Level Crossing, either single track or double track according to circumstances, looks well alongside a country station, in which position it usually occurs in actual practice. The Viaduct may be placed at almost any point in between stations. This realistic accessory may be made up to any length by the addition of centre sections that can be obtained separately.

Gradient Posts placed by the side of the line give a finished appearance to any layout. In arranging them it should be remembered that when a line reaches the top of a hill it has to descend on the other side; so that the posts should be arranged to indicate both the rise and the fall. Mile Posts also help out the effect. The best method of dealing with them is to decide that so many rail lengths shall represent a quarter-mile, so that the distances of the posts apart will be regular and proportionate.

The Platelayer's Hut looks well by the lineside clear of, but not very far from, a station. The Watchman's Hut, which is very realistic with its brazier, shovel and poker, may be placed near the mouth of a tunnel, or at the junction of a branch line with the main line.

The various Notice Boards need little comment. The "Caution" board is most realistic at the approach to a level crossing or a busy junction, and the "Whistle" board might guard a level crossing, a locomotive shed, or any point where people might be regarded as likely to cross the line.

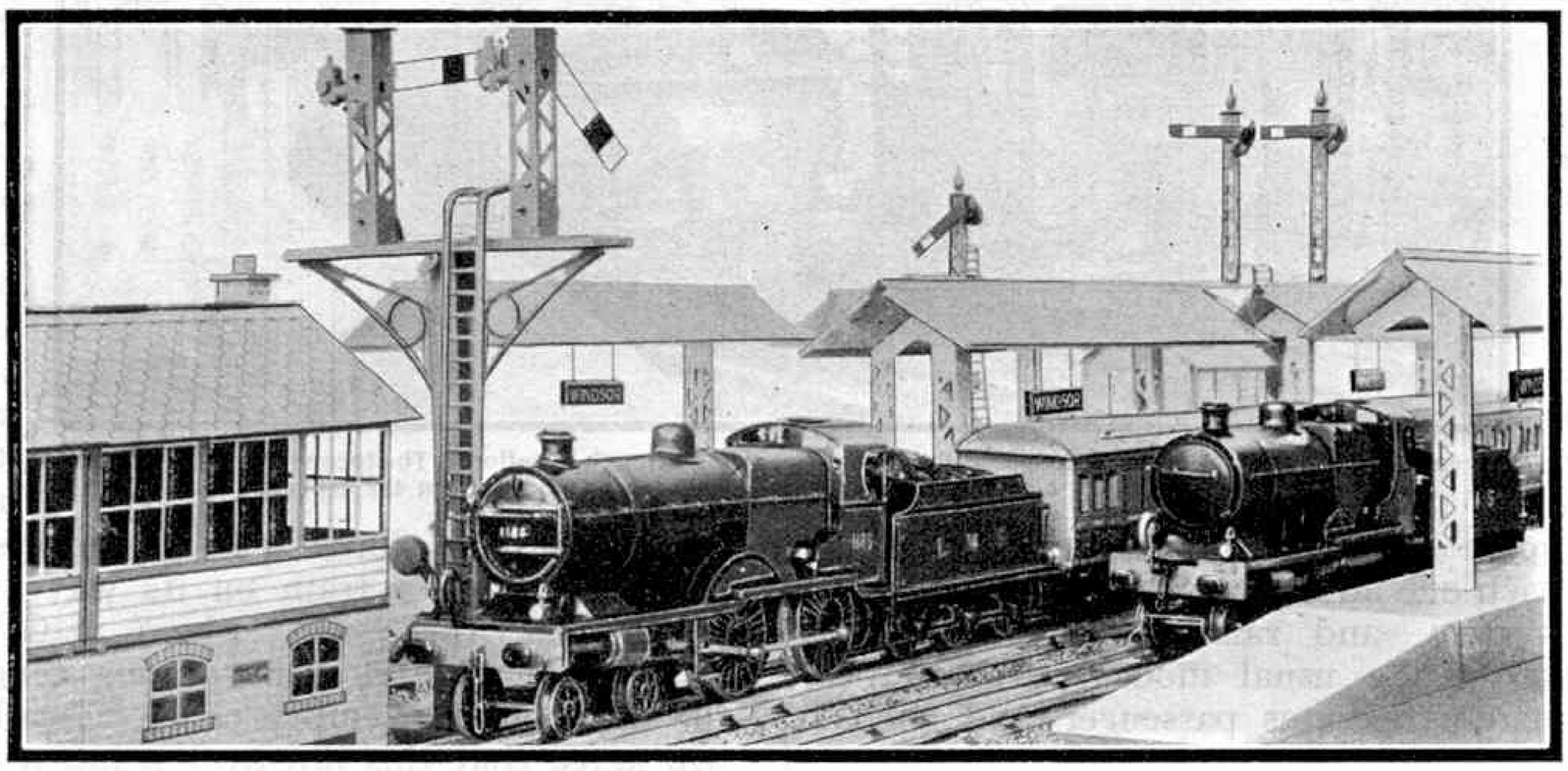


The realistic appearance of the Hornby Platelayer's Hut is shown in this picture. A double-headed Hornby Pullman express is seen passing a wayside station.

No model railway can be regarded as complete without a series of Hornby telegraph poles at regular intervals by the side of the line. In order to secure the best effect the insulators should be joined by black thread to represent telegraph wires.

The correct placing of signal boxes is of the utmost importance. It is essential that they should be situated so that the signalman should have a clear view of the operations carried out under his control and for this reason a good position for a cabin is at the head of the station platforms. This is shown in the lower photograph on this page, which represents a junction station on a Hornby Railway. Additional interest is given to the photograph by the presence of the two L.M.S.R. Compound locomotives. The one shown starting off with the train has just replaced the other, this locomotive having completed the first portion of the journey.

A suitable position for the box is especially necessary where the Hornby Control System is in use so as to make the operation of the levers as convenient as possible for the operator.



A layout showing a signal cabin appropriately placed at the end of the platforms of a junction station. The signalman thus has a clear view of all operations.

The Hornby paled fencing that is used on the Passenger Platforms and also the stations may be obtained separately at 6d. per length, and is particularly useful for placing along the lineside and may be used in many places to great advantage. Being finished in white its appearance is distinctly picturesque, and its use considerably improves the general effect of a layout.

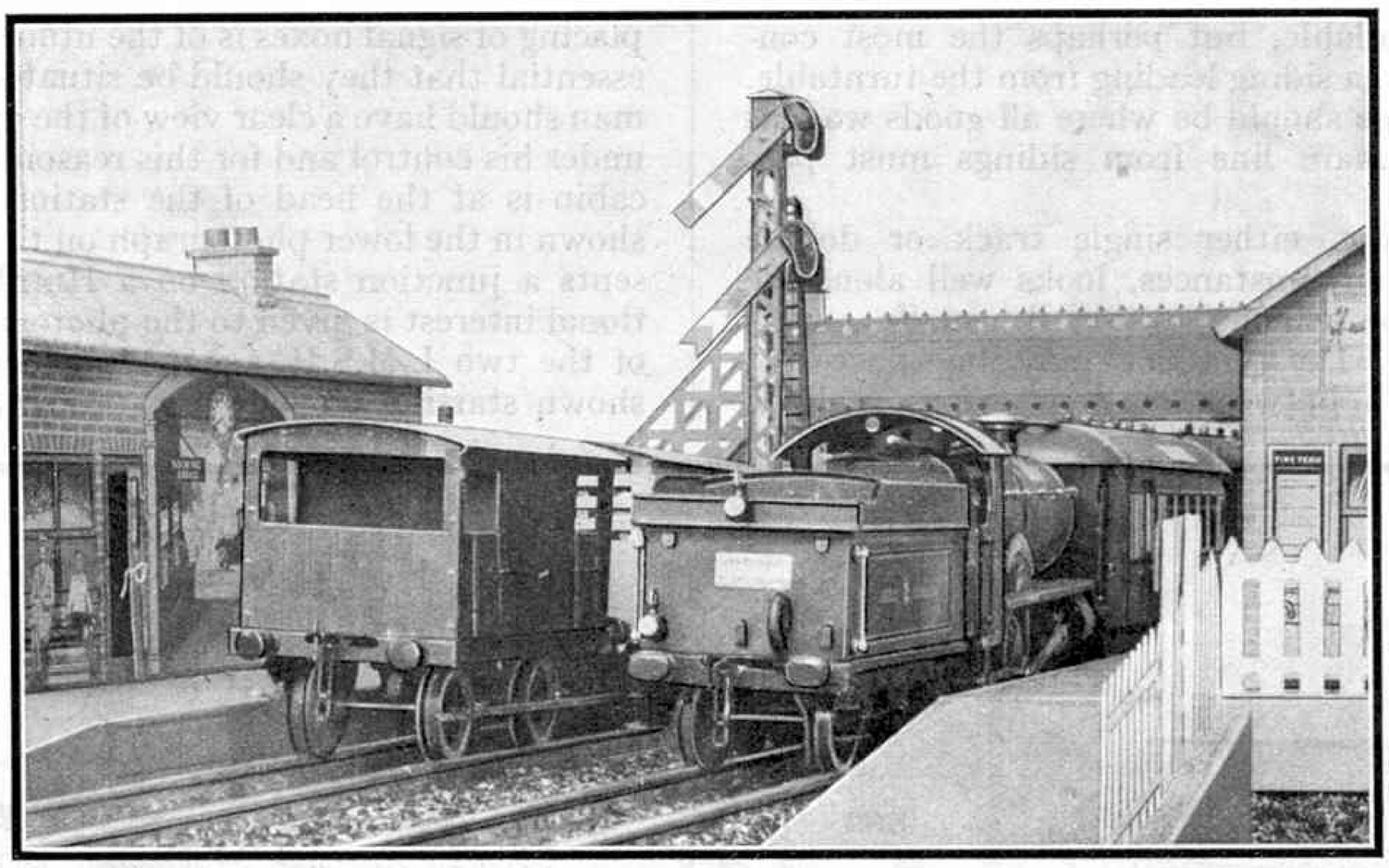
The miniature sacks which are included in the Meccano accessories are, of course, very suitable for conveyance in Hornby open wagons. They may be loaded or unloaded easily by the crane mounted on the Goods Platform.

XXVII.—NOVEL OPERATIONS ON HORNBY LAYOUTS

A great majority of Hornby Railway enthusiasts devote themselves almost entirely to the running of normal passenger trains, whether of the express or local type, and of goods trains of various forms of make-up. There is of course an endless amount of fun to be obtained from these operations, but there are other phases of railway working of great interest that are too often overlooked. H.R.C. members are always on the look out for fresh ideas and new schemes, and therefore we will outline briefly some of the neglected types of operation. These include empty coach manœuvres, light engine movements, possibly together with a goods brake van, and the handling of locomotives that are proceeding from their depot to a terminus in order to commence their day's work. We will refer also to the locomotives used for assisting duties, relief and excursion trains, and other work of a special nature. Enthusiasts will do well to pay some attention to these features of train working, as each one adds interest and importance to a miniature system, and raises its standard of realism above that of the usual model railway, the owner of which merely operates passenger and goods trains in turn.

Let us consider first empty coach movements, such as disposal of carriage stock after the arrival of an important express at a terminus. On actual railways this work is efficiently carried out by small tank engines, and scarcely comes under the notice of the average railway traveller. When an express reaches its destination, if traffic is heavy, the coaches are removed within about half-an-hour or less of the train's arrival, and possibly the train engine, still coupled to it, will give a friendly push from the rear while the shunting locomotive pulls from the other end. In this case the shunter hauls the coaches to the carriage sidings, where they are cleaned and prepared for the next trip, while the main line engine proceeds to the locomotive depot. On a Hornby Railway this work may be performed in a realistic manner by the No. 1 Tank or No. 2 Special Tank Locomotive, acting as the station shunter, or "pilot" as it is sometimes termed. The express engine will of course probably be a No. 3 or a No. 2 Special Locomotive.

Sometimes in actual practice a train of coaches has to be taken empty from the sidings to a certain station some distance away in order to pick up a special excursion party. The coaches are usually drawn by the train engine, possibly running tender first, though this depends upon the direction the train is to take when the party are aboard. Assuming that a reversal is necessary at the station, the locomotive crosses to the adjoining line and runs round the train in the usual manner while the coaches are filling with passengers. A good illustration of such a train on its way to collect a party appears on this page, where a G.W.R. "County" class locomotive is seen running tender first carrying the appropriate "empty coach" headlights. Readers will agree that this illustration has a remarkable touch of realism about it, and it is of interest to note that this is not due to the presence of an exceptional amount of equipment in the photograph, but merely to the fact that the picture represents a typical railway scene.

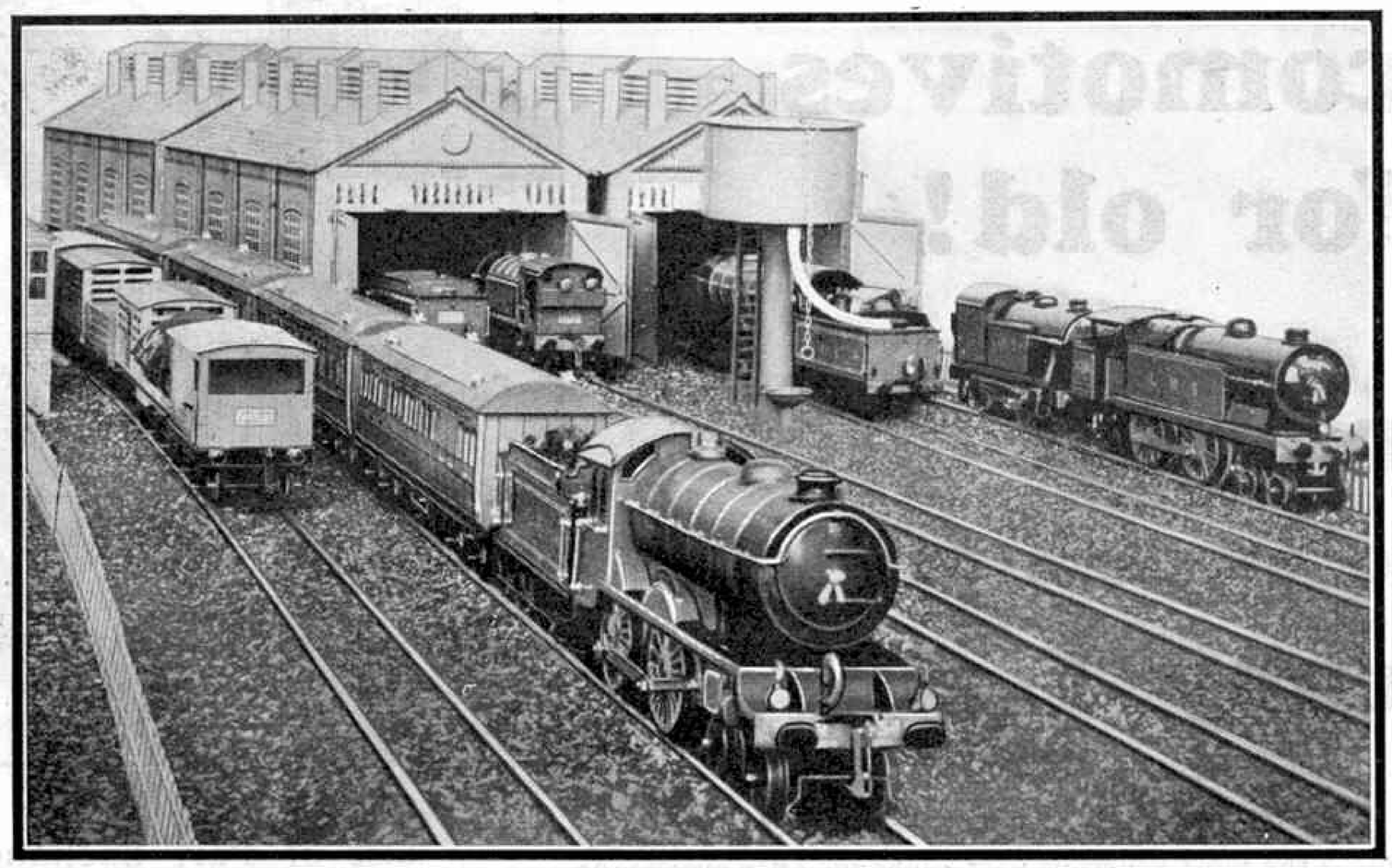


An empty coaching stock train composed of Pullman cars passing through a station. The locomotive is the Hornby "County of Bedford," carrying the appropriate head-lamp indication on the tender.

It invariably happens that the chief locomotive depot in a city or town is situated at some distance from the terminal station that it mainly serves, and on this account it is quite a common sight to see several engines coupled together proceeding from the shed to the terminus where they are to take up their individual duties. This sometimes presents an amusing spectacle, since there may be perhaps two large express passenger

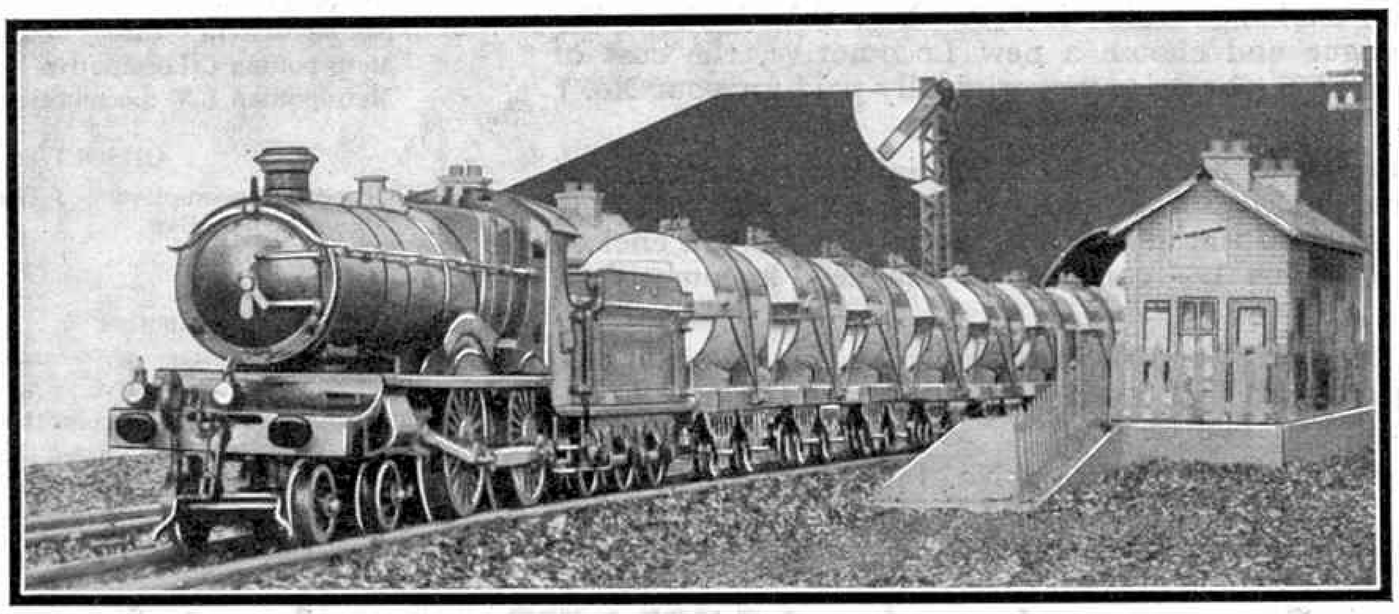
locomotives, a small goods tank engine, a small passenger engine and possibly a passenger tank of medium size. These may be chimney to chimney or tender to tender, and owing to different sizes of driving wheels their coupling rods will revolve at different rates and assume many different positions relative to one another.

Naturally the normal services of express, suburban and goods trains should not be neglected for features of this character; in fact in order to carry on the usual services efficiently it may be necessary to send a number of engines from the sheds to the terminus at the same time. Provided they can be quickly disposed of on arrival, on to their different trains or on to a suitable engine road, they cause less dislocation of services by travelling along together than by each proceeding in turn along the line as required. Where systematic working by timetable is a rule, such movements of locomotives "in bulk," as it were, should be allowed for in drawing up the general working arrangements.



Passenger and goods trains passing a locomotive depot on a Hornby railway. The two tank locomotives coupled together on the extreme right are about to proceed from the shed to their duties.

An engine movement that may be considered rather differently from the ordinary light engine movements is the running of a locomotive together with a goods brake van. This occurs where a locomotive is proceeding to a yard some distance away in order to marshal and pick up a train of wagons awaiting it there. These wagons may have been loaded in a goods station from road vehicles, or possibly on a quayside from a cargo ship. The engine therefore proceeds from the shed and takes along with it a brake van in order to complete the train as soon as it is ready for moving. The sight of a locomotive together with a brake van proceeding along a miniature line to a distant siding will arouse considerable interest and be a step further towards the realism that is so desired by all miniature railway operators. It is interesting to note that a locomotive with a brake van, or even by itself, constitutes a "train" in the traffic sense, and therefore carries a tail light according to regulations. A special indication is used at the front end in the form of a single lamp placed in the centre of the buffer beam. The same indication is used also for a light engine, or for a light engine and brake van.

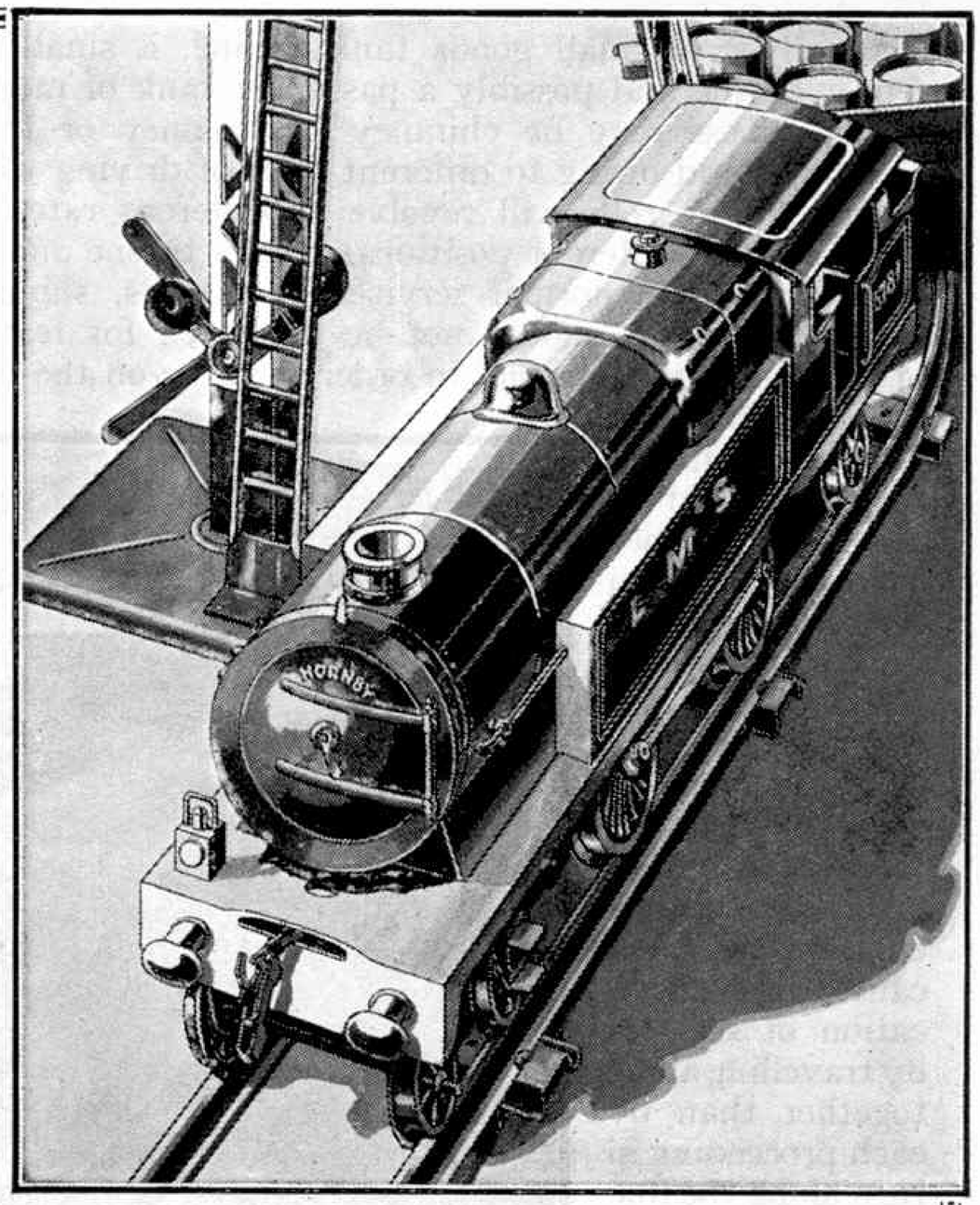


A bulk consignment of milk carried in Hornby "United Dairies" Tank Wagons. This is a good example in miniature of the latest modern practice for the conveyance of this traffic.

In previous articles we have mentioned the examples of train working to be found in the many fast goods trains that are such an important feature of modern railway operation. These trains are of such interest to model railway owners that we take this opportunity of referring again to them. Bulk consignments of frozen meat, fish, fruit, milk and other perishable goods are handled at express speed, nearly always in trains composed exclusively of wagons specially fitted for a particular kind of traffic. The illustration of a complete train of "United Dairies" Milk Tank Wagons is a splendid example of this practice carried out in miniature. This method of transporting milk in bulk is becoming widely adopted on British railways in order to obviate the trouble and delay of handling hundreds of separate milk cans. Even so the number of milk cans dealt with on our railways reaches high figures. If all the churns dealt with at Clapham Junction on the Southern Railway during one year were placed side by side, they would reach from Waterloo to Guildford, a distance of 30 miles! Although the milk traffic on Hornby railways is not on a proportionate scale, the use of the well-known Hornby Milk Van, and the churns that are provided with it, is to be recommended, especially where a certain amount of milk traffic is dealt with by a local passenger train, having perhaps a single milk van attached either next to the locomotive or at the rear.

Many other instances of this kind of traffic occur, such as trains made up entirely of cattle wagons, either in connection with some market or agricultural show; or the through running of fast trains conveying imported meat and fruit. Appropriate wagons are available in the Hornby Series for these traffics, and the running of such trains gives a model railway a new appearance of importance. In a similar manner complete trains of open wagons conveying coal and mineral traffic, or even bricks and slates, are frequently seen, and hints on the methods of representing appropriate loads for these have been given in the *"M.M."* from time to time. There are also special trains conveying heavy engineering products, which may be effectively represented by Meccano parts.

BOYS,
New Locomotives for old!



Wonderful offer
to owners of
Hornby Trains

Just think of it—an allowance of 50% for your old Hornby Locomotive ! This is the most generous part exchange offer ever made.

You have probably been using a Hornby Locomotive for some years and would now like to replace it by one of the fine new models that are shown in the 1931 Hornby catalogues. Our new Part Exchange scheme helps you to do this.

No matter what is the age or condition of your old Locomotive we will allow half the price you originally paid for it. The only condition being that the catalogue price of the new Locomotive you select must ***not be less than the price you paid for your old engine.***

What you have to do

Here is an example of how the plan works. Assuming you have a No. 1 Tank Locomotive that you wish to exchange, you see from the list opposite that its exchange value is 6/3. You then look at the Hornby Train catalogue and choose a new Locomotive, the cost of which is not less than 12/6 (the price you originally paid for your No. 1 Tank Locomotive).

Say that you decide to have a No. 2 Special Tank, the price of which is 25/–. You pack up your old No. 1 Tank and, deducting 6/3 from 25/– (the price of the new No. 2 Special Tank), you enclose a remittance for 18/9 plus 1/– carriage on the new Locomotive—19/9 in all.

You send the Locomotive and the remittance to Meccano Limited, Special Service Department, Old Swan, Liverpool, and the new Locomotive will then be despatched to you.

Alternatively, you can take your old No. 1 Tank Locomotive to your dealer with a remittance for 18/9, and he will give you the new No. 2 Special Tank Locomotive you require.

List of Part Exchange Values of Hornby Locomotives

CURRENT TYPES

M1/2 Locomotive No. 3031	2/3
No. 0 Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	16/3
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera " Blue " Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera " Blue " Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	23/9

OBSOLETE TYPES

George V Locomotive, No. 00 Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
Metropolitan H.V. Locomotive	26/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6

A Hornby Locomotive is ALWAYS worth at least half the price you pay for it

HORNBY TRAINS

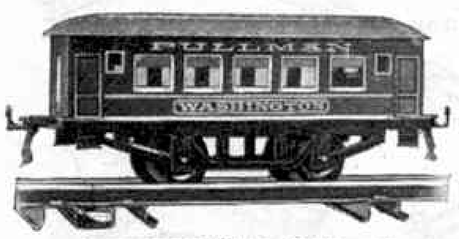
BRITISH AND GUARANTEED

MECCANO LTD. — SPECIAL SERVICE DEPT. — OLD SWAN — LIVERPOOL

American-Type Hornby Rolling Stock

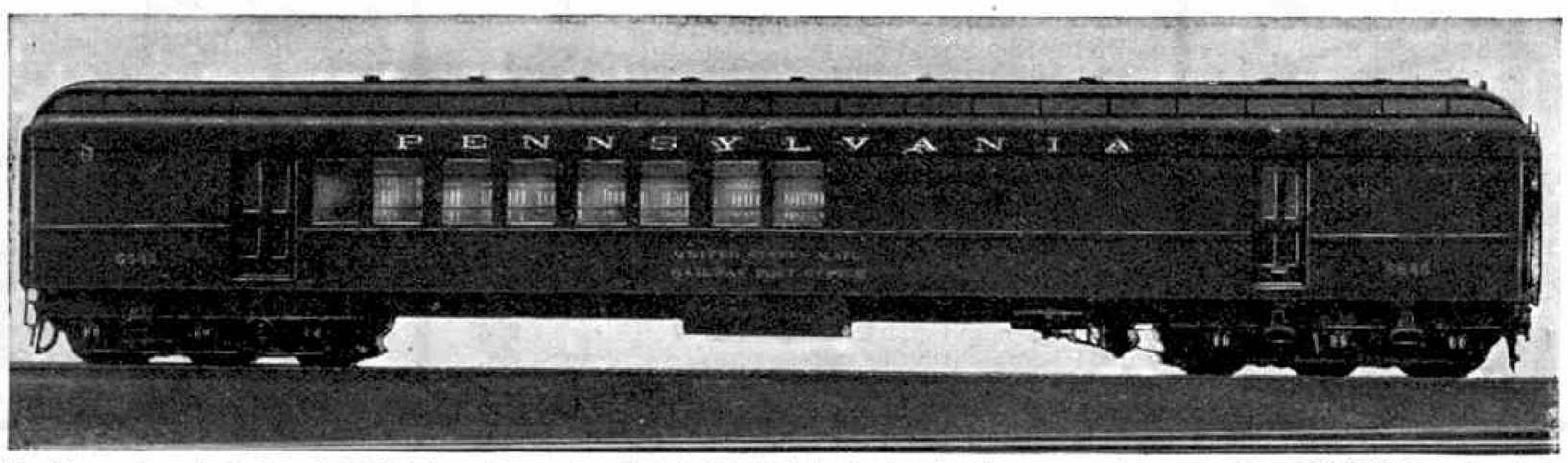
By "Tommy Dodd"

THE recent inclusion in the Hornby Series of rolling stock of American design will, I am convinced, be welcomed by a large number of model railway enthusiasts. It is interesting to note that these additions to the Series, together with the French types of rolling stock introduced some time ago, enable Hornby Railway owners to employ on their layouts rolling stock of three different countries, thus adding new interest to the various operations.



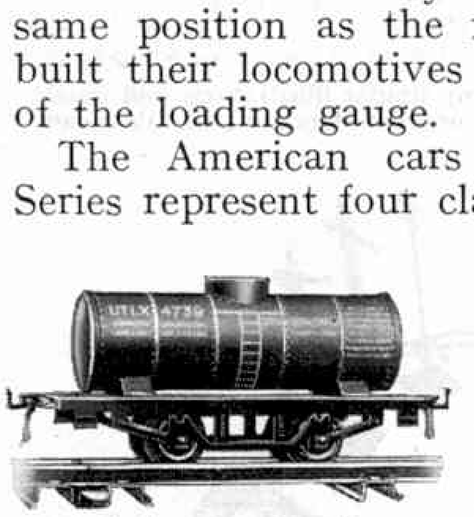
American-Type Pullman.

There are many differences between the rolling stock of America and that of this country, but the most obvious and striking one is in regard to size. Although the American railways are laid down to the same standard gauge as English railways, 4 ft. 8½ in., they have a loading gauge of about 16 ft. as compared with the 13 ft. 6 in. in general use in this country. Profiting by the lessons learned from our pioneer work, the Americans built their bridges and other cross-line structures of a height to allow a considerable development in the size of their railway vehicles, and the result has been a steady increase in the size of American locomotives and rolling stock of all kinds. The standard American railway vehicle of to-day would not pass under the bridges over our railways, and indeed it dwarfs our largest rolling stock. Before long, however, the American railway companies will be in much the same position as the four British groups, in having built their locomotives and rolling stock to the limits of the loading gauge.



The Pennsylvania Railroad (U.S.A.) mail coach. This is 74 ft. 4 in. in length, has a carrying capacity of 30,000 lb. and weighs 125,000 lb. It is devoted entirely to the handling of United States mail, and comprises a complete travelling post office.

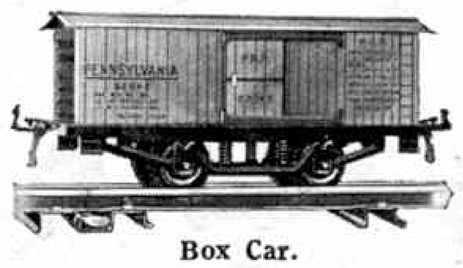
The American cars introduced into the Hornby Series represent four classes of rolling stock, the Tank Car, the Box Car, the Pullman Car, and the Caboose.



Tank Car, American Type.

The Tank Car is a very realistic model of the cars owned by the Union Tank Car Company, who have very large numbers of this type of wagon. They are used extensively for the transportation in bulk of oil from the oil wells. The car is longer than the ordinary English petrol tank wagon, and consequently its capacity is much greater. It is very necessary that the American tank cars should be large, for the oil from the wells is produced in immense quantities and must be transported with the least possible loss of time, first to the refineries and then to the distributors. Whole trains consisting of tank wagons are in regular use, and the quantity of oil they convey is enormous. A train made up of three or four of these new Tank Cars looks extremely attractive and realistic when running on a Hornby layout.

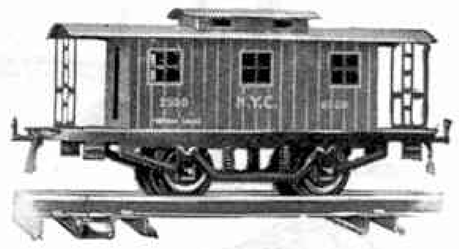
It will be noticed that various details regarding capacity, etc., are printed on the sides of the Tank Car. This is in accordance with actual American railway practice, and it forms an interesting feature of the model. The details regarding coupling, braking and other matters are very necessary in America, where many varieties of these devices are in use on the different railways.



Box Car.

The Box Car is one of the commonest of all the wagons used on American railways. Our model represents the type in use on the Pennsylvania Railroad, and it is employed for nearly all purposes, from the conveyance of perishables to that of ordinary luggage. Its all-round utility makes it of great importance, and in this respect it corresponds to the closed van in general use in this country, except of course that its capacity is considerably greater than that of the British vehicle. The model is fitted with sliding doors that add greatly to its appearance and at the same time allow it to be loaded quite easily. It is finished in yellow, with black lines to represent the joints in the wood of which the prototype is constructed; and, as in the case of the Tank Car just described, full particulars are painted on the sides. At one corner of the roof of the Box Car there is an interesting and realistic representation of the American type brake control, which adds considerably to the effective appearance of the car.

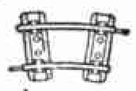
The Pullman Car is built on similar lines to the Pullman cars used to such a great extent on American railways. It is obtainable in either yellow or green, and lettered *"Madison"* or *"Washington"* in either colour. A feature of the car is the imitation clerestory roof.

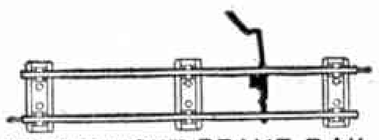


Caboose.

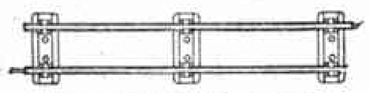
The last of these American-type vehicles is the Caboose. This is a realistic model of the type of brake van in general use in America. It has a raised centre roof, and is complete with the roof ladders that are characteristic features of the actual vehicle. It is coloured green, and lettered to represent the New York Central Railroad.

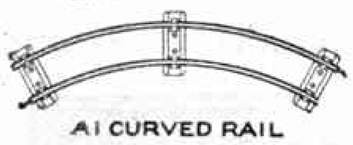
HORNBY SERIES
Rails Points and Crossings

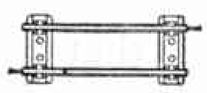

A1¼ CURVED QUARTER RAIL

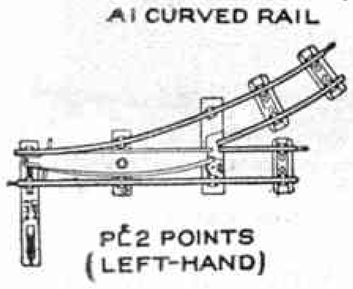

BB1 STRAIGHT BRAKE RAIL

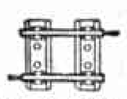
A1½ CURVED HALF RAIL

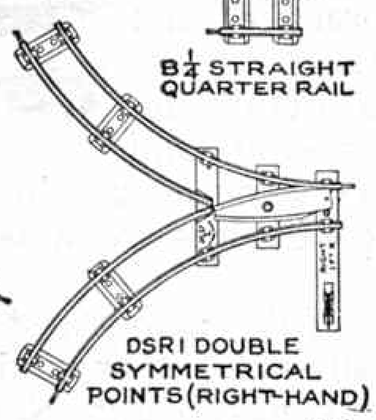

B1 STRAIGHT RAIL

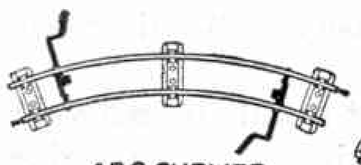

A1 CURVED RAIL

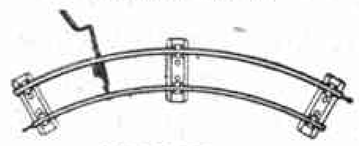

B½ STRAIGHT HALF RAIL

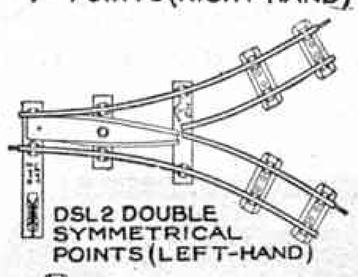

PC2 POINTS (LEFT-HAND)

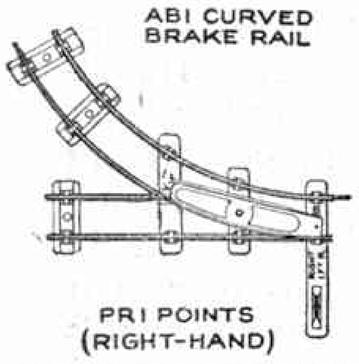

B¼ STRAIGHT QUARTER RAIL

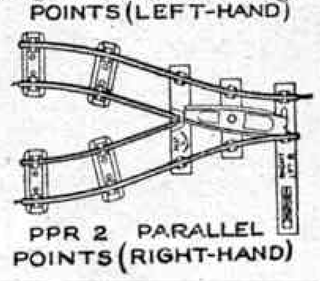

DSR1 DOUBLE SYMMETRICAL POINTS (RIGHT-HAND)


AB2 CURVED BRAKE RAIL


AB1 CURVED BRAKE RAIL


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


PR1 POINTS (RIGHT-HAND)


PPR 2 PARALLEL POINTS (RIGHT-HAND)

For Clockwork & Steam Trains

CURVED RAILS

9-in. radius (For M0 Trains)

M9	Curved rails	doz.	3/–
MB9	Curved brake rails	each	3½d.

1-ft. radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/–
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/–
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right	per pair	5/–
DSL1	Double symmetrical points, left		

For 2-ft. radius curves

DSR2	Double symmetrical points, right	per pair	5/–
DSL2	Double symmetrical points, left		

PARALLEL POINTS

PPR2	Parallel points, right ...	per pair	5/–
PPL2	Parallel points, left ...		

CROSSINGS AND CROSSOVER POINTS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/–
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	2/–
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9
COR2	Crossover points, right-hand	per pair	12/–
COL2	Crossover points, left-hand		

POINTS

9-in. radius (For M0 Trains)

MR9	Right-hand points ...	per pair	3/–
ML9	Left-hand points ...		

1-ft. radius

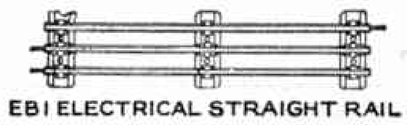
PR1	Right-hand points ...	per pair	4/–
PL1	Left-hand points ...		

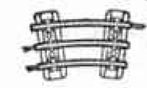
2-ft. radius

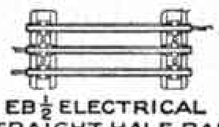
PR2	Right-hand points ...	per pair	4/–
PL2	Left-hand points ...		
PSR2	Points on solid base, right-hand	per pair	8/6
PSL2	Points on solid base, left-hand		

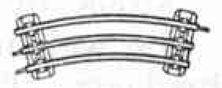
STRAIGHT RAILS

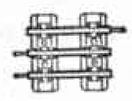
BM	Straight rails (for M0 Trains) ...	per doz.	2/9
B1	Straight rails	„	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track ...	½ doz.	6/6
RCP	Rail connecting plates	„	4d.


EB1 ELECTRICAL STRAIGHT RAIL

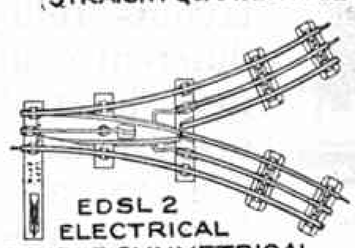

EA1¼ ELECTRICAL CURVED QUARTER RAIL

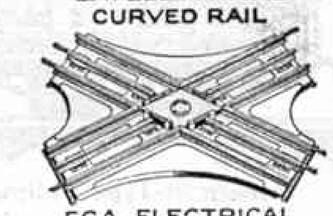

EB½ ELECTRICAL STRAIGHT HALF RAIL

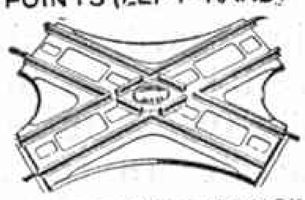

EA1½ ELECTRICAL CURVED HALF RAIL

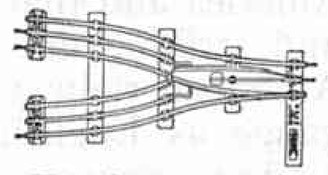

EB¼ ELECTRICAL STRAIGHT QUARTER RAIL

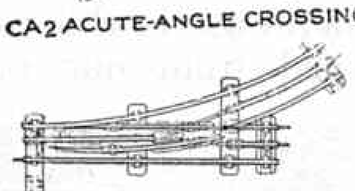
EA1 ELECTRICAL CURVED RAIL

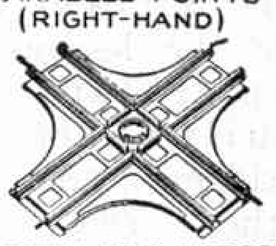

EDSL2 ELECTRICAL DOUBLE SYMMETRICAL POINTS (LEFT-HAND)

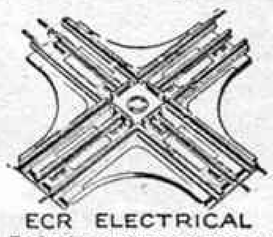

ECA ELECTRICAL ACUTE-ANGLE CROSSING

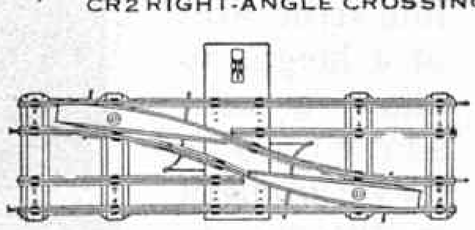

CA2 ACUTE-ANGLE CROSSING


EPPR2 ELECTRICAL PARALLEL POINTS (RIGHT-HAND)


EPL2 ELECTRICAL POINTS (LEFT-HAND)


CR2 RIGHT-ANGLE CROSSING


ECR ELECTRICAL RIGHT-ANGLE CROSSING


COR2 CROSSOVER POINTS

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	6/6
EA1½	Curved half rails	„	4/6
EA1¼	Curved quarter rails	„	4/–

2-ft. radius

EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails	„	4/–
EDC2	Curved rails, double track ...	½ doz.	9/–

Rails for Electric Trains

STRAIGHT RAILS

EB1	Straight rails	per doz.	6/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/–
EDS1	Straight rails, double track ...	½ doz.	8/6

CROSSINGS

ECA	Acute-angle crossings	each	4/–
ECR	Right-angle crossings	„	4/–

POINTS

For 2-ft. radius curves

EPR2	Right-hand points ...	per pair	7/6
EPL2	Left-hand points ...		

DOUBLE SYMMETRICAL POINTS

For 2-ft. radius curves

EDSR2	Double symmetrical points, right	per pair	8/6
EDSL2	Double symmetrical points, left		

PARALLEL POINTS

For 2-ft. radius curves

EPPR2	Parallel points, right ...	per pair	8/6
EPPL2	Parallel points, left ...		
TCPL	Terminal connecting plates (low voltage)	each	1/6

Electrical Points for 1-ft. radius curves are not supplied

The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many similar illustrations and much useful information is given in a booklet entitled " How to Plan your Hornby Railway." This booklet is obtainable from your dealer price 3d. or from Meccano Ltd., Old Swan, Liverpool, price 4d. post free.

Manufactured by MECCANO LTD., OLD SWAN, LIVERPOOL

H.R.C. COMPETITION PAGE

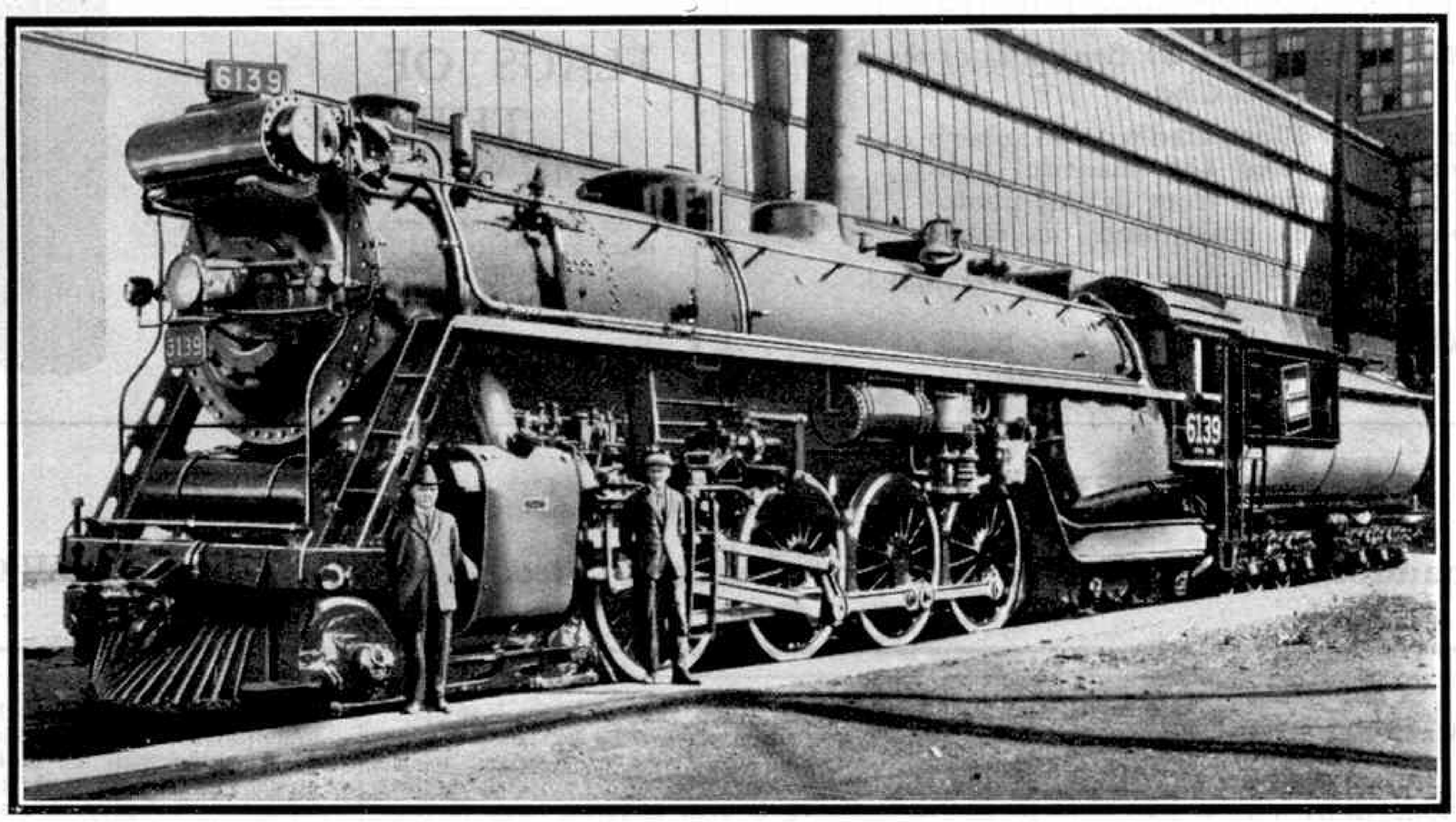
Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

CANADIAN LOCOMOTIVE CONTEST

ALTHOUGH only a small proportion of H.R.C. members have had the opportunity of seeing for themselves the locomotives of Canada and the United States, all are familiar with these magnificent locomotives through the many photographs that have been published in the "*M.M.*" and in other journals. In addition, those who visit the cinema regularly will have seen many films of scenes on the American continent in which trains play an important part.

The first thing that strikes us about a Canadian or an American locomotive, whether we see it in reality or in a photograph, is its enormous size in comparison with even the largest British locomotives. This development is, of course, the result of a loading gauge of more liberal proportions, of which designers have taken full advantage. Another point that instantly attracts our attention is that while the British locomotives to which we are familiar have beautifully designed external lines, these Canadian and American monsters appear to have no lines at all! They are covered with strange looking mechanisms that give the impression of having been simply dumped down. The fact is that the locomotive designers on the North American continent pay little regard to appearance, their efforts ending with the securing of maximum efficiency. The result is that many working parts that are ugly in themselves are placed in positions that emphasise their lack of beauty, simply because in this position they operate most effectively and are most easily reached for repair or adjustment.

It is interesting to note that during recent years British designers have shown a slight though distinct tendency to follow American practice in this respect; while on the other hand since the visit of "*King George V*" to America in 1927 American locomotives have been built with a marked similarity to this fine locomotive's general appearance.



How does this C.N.R. locomotive differ from British practice?

Many of the fittings that are so prominent on a Canadian or an American locomotive are very similar to corresponding fittings on British engines, except that in many cases they are larger. There are, however, many special mechanisms that are not to be found on British locomotives.

It is interesting to try to identify the various fittings and mechanisms that are conspicuous on a locomotive such as the Canadian National giant illustrated on this page. To encourage H.R.C. members to tackle this fascinating problem we offer this month prizes for the best lists of fittings and mechanisms on this C.N.R. locomotive that differ in position or design from corresponding mechanisms fitted to British locomotives, or are not to be found in British locomotives at all. Each item must be listed separately, together with a brief note in regard to it. If, in addition to describing differences in design, competitors can explain how these differences have originated they should endeavour to do so.

When the various items have been accounted for competitors should mark their entries with their names and H.R.C. membership numbers, and forward them in an envelope marked H.R.C. "Canadian Locomotive Contest" to Meccano Limited, Binns Road, Old Swan, Liverpool.

The contest will be divided into the usual two sections Home and Overseas. In each section prizes of Hornby Train Material, or Meccano products if preferred, to the value of £1-1s., 15/–, 10/6 and 5/– respectively will be awarded to the four best entries received in each section. A number of consolation prizes will also be awarded. Entries should be posted so as to reach Headquarters not later than 31st January 1931. The closing date for Overseas entries is the 30th April, 1931.

Each competitor should take care to mark his entry with his H.R.C. number as failure to do this will result in disqualification.

Can You Answer These?

We have had a large number of requests for competitions consisting of questions dealing with various railway matters, by means of which H.R.C. members might test their railway knowledge. As an experiment in this direction we now announce a contest of this nature. Competitors are required to send in brief answers to each of the following nine questions, or as many of them as they can.

1. Who was the designer of the G.W.R. locomotive "*King George V*"? 2. What is the total loaded weight of the "*Royal Scot*" locomotive and tender? 3. What purpose does the dome serve? 4. What are the four main parts of a locomotive boiler? 5. What are "Compound" locomotives? 6. Why do express engines have large wheels and freight engines small wheels? 7. What is meant by piston stroke? 8. Which was the first railway to use 4–6–0 locomotives? 9. What is meant by adhesion weight?

To the readers who send in the four best sets of answers, prizes of Hornby Railway material, or Meccano products, will be awarded to the value of 15/–, 10/6, 5/– and 2/6 respectively. Each sheet of paper contained in an entry must bear the competitor's name, address and H.R.C. number. Envelopes should be marked "H.R.C. Questions Contest," and be addressed to Meccano Limited, Binns Road, Old Swan, Liverpool. The closing dates are—Home Section, 31st January. Overseas Section, 30th April, 1931.

H.R.C. Competition Results

HOME

October "Jumbled Signals"—1. J. F. GRINDLEY (2067), Whittington, Oswestry; 2. L. SNOOK (1761), Reading; 3. D. J. WORRALL (11502), Sheffield; 4. F. HODSON (9430), Bolton, Lancs.

October "My Favourite Railway"—1. E. D. BAILEY (6428), Romford, Essex; 2. J. F. C. MORDEN (17318), West Ham, E.16; 3. D. G. TUCKER (16329), Chingford, E.4; 4. R. G. JENNINGS (17345), Birmingham.

November "Hidden Expresses"—1. L. MITCHELL (11967), Stockton-on-Tees; 2. A. F. MILBURN (16322), Chingford, London, E.4; 3. A. S. DALLAWAY (12662), Pevensey, Sussex; 4. G. A. MCCASKIE (7710), Hillhead, Glasgow.

November "Railway Drawing"—1. D. M. WALBOURN (2896), Loughborough; 2. L. T. LEVITT (7965), Sketty, Swansea; 3. R. SMITH (14750), Ossett; 4. D. R. BAKER (18664), Crouch End, London, N.8.

November "A Standard British Loco"—1. M. J. SKINNER (8793), Bilston, Staffs.; 2. D. STAMFORD (17558), Merstham, Surrey; 3. D. G. TUCKER (16329), Chingford, London, E.4; 4. A. FELTHAM (14634), Worthing.

OVERSEAS

July "Missing Links"—1. M. R. INCE (11327), Mt. Eden, Auckland, N.Z.; 2. H. N. JOHNS (15661), Leichhardt, N.S.W.; 3. J. H. RODRIGUEZ (3647), Montreal, Canada; 4. F. E. MILLS (9375), Jalarpet Junction, South India.

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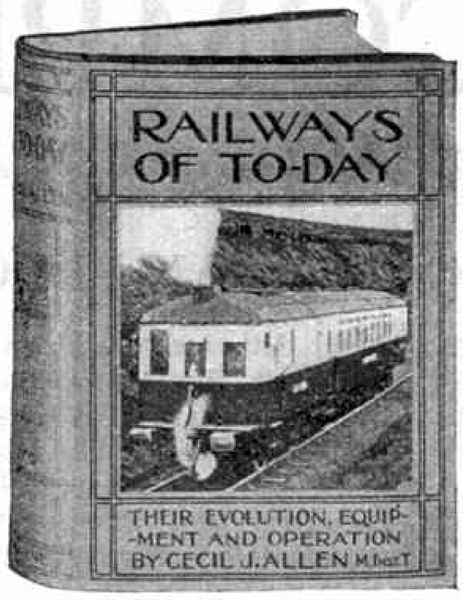

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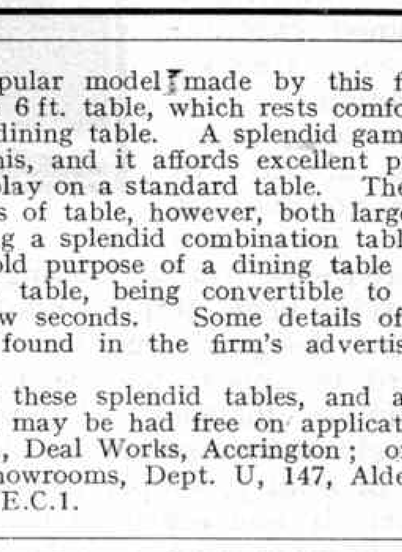


FREDERICK WARNE & CO. LTD.

Chandos House, Bedford Court, Bedford Street, Strand, London, W.C.2

Charles Letts's Diaries

The appearance year by year of a new issue of Letts's famous diaries is a sure reminder of the approach of Christmas. Among the samples we have received, a prominent place must be given to the popular Schoolboy's Diary. It is, if possible, fuller of information than ever, and it contains a variety of material that is of interest to every boy.

The Boy Scout's Diary, which is on similar lines to the previous issue, is a marvel of cheapness, and is almost invaluable to all Scouts and Wolf Cubs. The Wireless Diary should make a wide appeal among all wireless enthusiasts, for in addition to the usual features of a diary it contains many pages of notes of real practical value on the maintenance of wireless receivers.

A newcomer to the series is the Motor Cycling Diary. This contains articles on road law, licenses and taxation, the maintenance of machines, records of all kinds, and other information on questions that crop up almost daily. The diaries are well printed and produced in an attractive and durable form.

Photographic Printing and Toning

A booklet under the title of "*Photography Simplified —Printing and Toning*," recently issued by Burroughs Wellcome and Co., deals with the making of prints on bromide and gaslight paper. In order to obtain the best results from these processes it is important that a suitable paper should be used for each type of negative, and this is clearly explained in the booklet by illustrations and practical hints. An easy and reliable method of finding the correct exposure for any negative without the waste of time and material is described, and advice is given on the development of prints.

Perhaps the most interesting section of the booklet deals with the remarkable effects that may be obtained by toning or staining prints. For instance, seascapes and snow scenes are often improved by being toned blue; and landscapes look well when toned to a suitable shade of green, Toning is quite a simple process, and staining is even more so. One of the illustrations shows the striking effect that may be obtained by a combination of toning and staining and suggests interesting possibilities in this direction.

A copy of the booklet will be sent, post free, to any reader who mentions this magazine by Burroughs Wellcome and Company, Snowhill Buildings, London, E.C.1.

A Pen for Sportsmen

The Waterman Stand, No. 34, First Floor, Empire Hall, Schoolboys' Exhibition, will again prove a source of great interest to schoolboys, and, for that matter, to parents also. Lovers of Football will see a Ball bearing the signatures of every member of the Arsenal Team, winners of the 1930 Cup Final. This was signed as a memento of the great event. Cricket enthusiasts will see Bats bearing the autographs of many famous players. Film-goers will be interested in a very quaint picture of Cherry Kearton, the great Explorer-Naturalist, writing his notes surrounded by Penguins. He is using a Waterman's Pen and the picture is a scene from the film "Dassan." Then there is a large-scale model of the Waterman factory at Montreal, together with a very fine display of Waterman's Pens, Pencils, Writing Sets, Desk Stands, Ink, etc.

We understand that copies of the Photo postcards of Cherry Kearton and Jack Hobbs are available gratis at the Stand while the supply lasts. Readers unable to visit the Exhibition may obtain one of each by writing to Messrs. L. G. Sloan Ltd., The Pen Corner, Kingsway, London, W.C.2, and mentioning the "Meccano Magazine" offer.

Home Billiards for Winter Evenings

The problem of providing interesting amusement during the long winter evenings is not an easy one to solve. There are many games suitable for occasional use, but very few that can be played night after night without ever becoming monotonous. Among these few a foremost place must be given to billiards, which combines excitement and interest to a greater extent than any other indoor game. A full-sized table is out of the question for an ordinary room, but all the fun of the game may be obtained on the small tables specially designed and built by Rileys of Accrington, whose name is known wherever billiards is played.

The most popular model made by this firm is undoubtedly the 6 ft. table, which rests comfortably on an ordinary dining table. A splendid game may be played on this, and it affords excellent practice for subsequent play on a standard table. There are many other sizes of table, however, both larger and smaller, including a splendid combination table that serves the twofold purpose of a dining table and a perfect billiards table, being convertible to either purpose in a few seconds. Some details of these tables will be found in the firm's advertisement on page 87.

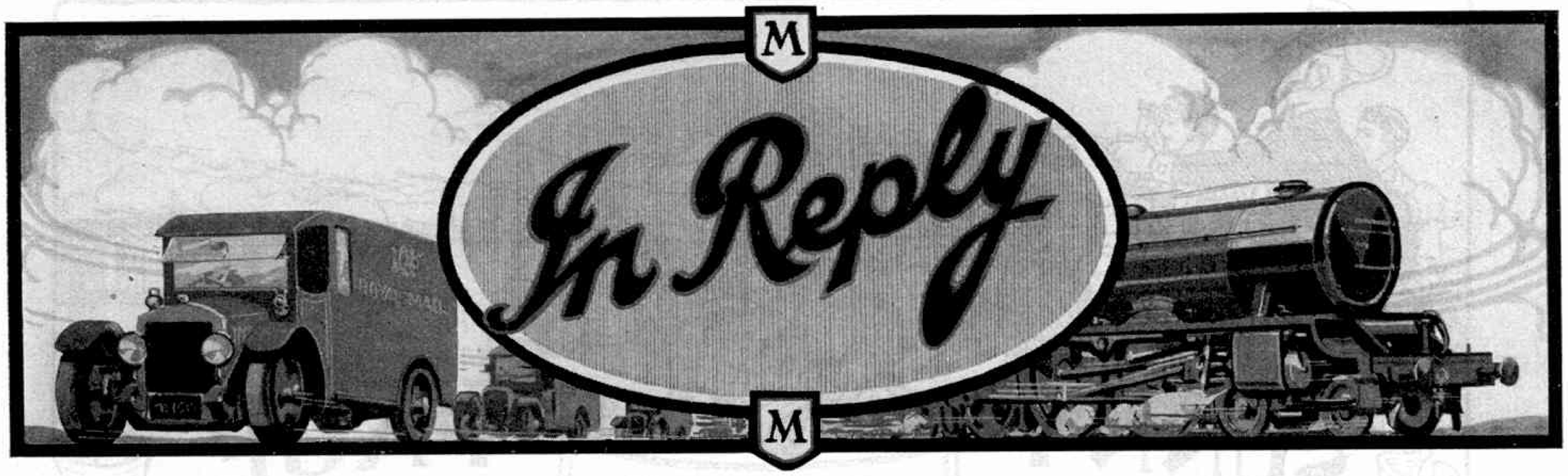
Price lists of these splendid tables, and also of bagatelle tables, may be had free on application to E. J. Riley Ltd., Deal Works, Accrington; or from their London Showrooms, Dept. U, 147, Aldersgate Street, London, E.C.1.

Wireless Cabinet Making Simplified

Wireless enthusiasts who have successfully assembled a set of their own naturally wish to construct for it a suitable cabinet. Provided that they have the necessary woodworking skill there is no difficulty about this, but a large proportion of amateurs do not possess this skill, and if they tackle the job at all, produce very unsatisfactory results. With the object of helping such amateurs Messrs. J. J. Eastick & Sons have introduced a building system under the name "*Byldurone*," which enables anyone to construct a cabinet that combines good appearance and efficiency with cheapness and simplicity of construction.

All the tools required are a saw and a screw-driver. Wood is supplied in standard lengths, 36 in. by 10 in. by 5/16 in., and 36 in. by 8 in. by 5/16 in., and sets of four angle pieces are obtainable in nickel, oxy-copper, oxy-silver, or covered to match the finishing materials for the cabinet, of which there is a wide range, including wood veneer and leathers. These ingeniously-designed angle pieces do away completely with the greatest difficulty with which the cabinet constructor is faced, namely, that of securing strong and neatly-fitted corners. Screening devices may be obtained or, if desired, metal-faced plywood may be used for the purpose. "*Byldurone*" components may be obtained through any good wireless dealer.

The "*Eelex*" products, which have been on the market since broadcasting started, are well known to "*M.M.*" readers. An interesting coloured leaflet of terminals, plugs and sockets has just been issued, and any reader may obtain a copy free on application to J. J. Eastick & Sons, Eelex House, 118, Bunhill Row, London, E.C.1.



Suggested Hornby Train Improvements

COACHES FOR SUBURBAN TRAINS.—We agree that compartment coaches would probably prove a popular addition to the Series. Suburban trains could then be represented on a Hornby railway, and we hope to include such vehicles at a later date. Meanwhile, as you are probably aware, the Metropolitan coach has been reduced to 8/6, and we suggest that you employ these coaches. (*Reply to T. W. Nott, Potters Bar*).

SOMERSET AND DORSET RAILWAY LOCOMOTIVES.—No useful purpose would be served by having Hornby locomotives painted in the colours of the Somerset and Dorset Joint Railway, as this line has been taken over by the L.M.S.R. and the S.R. In future the locomotives will be painted in standard L.M.S.R. colours and numbered in series with L.M.S.R. locomotives of similar classes. (*Reply to J. Naylor, Bournemouth*).

COLOUR-LIGHT SIGNALS.—This suggestion has been sent in several times, but as the colour-light signal has not yet been generally adopted as standard, we do not propose to introduce it in the Hornby System at present. We have the idea under consideration, however, as such signals are attractive and probably would prove popular. (*Reply to J. C. Cox, Preston*).

DOUBLE CROSS-OVER POINTS.—We hardly think this would be a suitable addition to the Hornby Series of points and crossings. A crossing of this kind certainly saves space by combining a facing and trailing crossover, instead of using one adjacent to the other; but we think it would have only a limited application on most Hornby railways. For one thing, it would necessarily be expensive. (*Reply to E. Watson, March*).

VANDERBILT PATTERN TENDERS.—Your suggestion is interesting and of course the type of tender with circular tank is more familiar to you. Such tenders are not used in Great Britain, however, and as most Hornby locomotives are based on British prototypes the use of these tenders would be incorrect. They would not be popular amongst H.R.C. enthusiasts at home, and insufficient demand exists abroad to justify their introduction. The cost would be somewhat high also. (*Reply to R. Ware, Perth, Australia*).

CATTLE WAGON WITH DROP DOORS.—Your suggestion is extremely interesting and we agree that a considerable increase in realism would result if a cattle wagon fitted with doors as in real practice were available. There are, as you say, several suitable prototypes to choose from, and their claims will be carefully considered when additions to the Rolling Stock are next taken in hand. (*Reply to T. W. Wood, Rugby*).

LEVEL CROSSING WORKED FROM SIGNAL CABIN.—We are interested in your proposal that we should arrange for the gates of our Level Crossing to be operated from the lever frame used for controlling signals. In order to make this possible, extensive alterations would be necessary to the present design and the cost of these would render the price of the accessory somewhat high. For this reason we are not likely to adopt the proposal. (*Reply to F. W. Coleman, Southport*).

SENTINEL-CAMMELL RAIL COACH.—These useful vehicles are used to a great extent on the L.N.E.R. but until their employment is as general on the other group railways we doubt if their popularity would be sufficient to justify the cost of their introduction. We are, however, considering the question carefully, and should any decision be reached an announcement will be made in the "*M.M.*" (*Reply to H. O. Carr, Durham*).

L.N.E.R. ELECTRIC LOCOMOTIVES.—A model of one of the L.N.E.R. electric locomotives in use on the Shildon-Newport line would no doubt be welcomed by Hornby enthusiasts in that district, but it would not be generally popular as it is little known elsewhere. (*Reply to F. Marley, Newcastle*).

Part of the layout operated by K. Murphy (H.R.C. 8905) of Bray, Ireland. A Pullman express hauled by a Hornby "Royal Scot" locomotive is passing a wayside station. The level crossing and other accessories render this photograph particularly interesting.

CHANGE OF NAME FOR No. 3 LOCOMOTIVE S.R.—We hardly think that the majority of Hornby Train enthusiasts would favour the change you propose. The "Lord Nelson" is the most popular and well-known locomotive on the Southern Railway, and we are hardly inclined to substitute for this title the name of one of the "Atlantic" type engines such as "Peveril Point." It is not possible for us to offer a choice of names and numbers on our locomotives owing to the high cost of the large stock of transfers that would be necessary. (*Reply to J. D. Culverwell, Croydon*).

L.M.S. 40-TON SELF-DISCHARGING WAGONS.—We agree that these are exceptionally interesting vehicles and representative of the most modern practice. Their use is, however, confined as yet to the L.M.S. and until there are corresponding wagons in use on other railway systems we think that there would be insufficient demand to justify their inclusion in the Series. We shall keep the proposal before us, however, for consideration when additions to our Rolling Stock next receive attention. (*Reply to F. Horner, Watford*).

DOUBLE TRACK VIADUCT.—We have received several suggestions for the inclusion of this accessory in the Hornby Series. We doubt if its popularity would be sufficient to warrant the expense involved in the production of such a large structure, and further, many Hornby Train owners would be unable to use it on their layouts because of its size. We shall consider the question of its introduction, but are of the opinion that this is scarcely likely. (*Reply to D. N. Cole, Ashford*).

TAR WAGON.—It is not practicable to introduce into the Hornby Series wagons such as this, which, while very common in certain districts, are unfamiliar to railway enthusiasts generally. (*Reply to D. Davidson, Chorley*).

TRACK CIRCUIT INDICATORS FOR SIGNALS.—This is a very good suggestion, and such indicators would look very realistic if they could be attached to signal posts in appropriate situations. The diamond-shaped plate usually used as an indication may readily be made of metal, or even cardboard, and attached to the signals as necessary. Consideration will be given to this proposal and any decision will be announced in the "*M.M.*" (*Reply to N. Bradford, Crewe*).

PERMANENT WAY REPAIR INDICATORS.—We do not propose to introduce lamps lettered "C" and "T," to indicate that relaying of the track is in progress. The notice board that is included in Railway Accessories Set No. 8, and lettered "Repairs," should be sufficient for the purpose. (*Reply to R. MacTavish, Glasgow*).

INDICATOR SHELTERS FOR HORNBY LOCOMOTIVES.—We do not think this accessory would prove popular, as it is only on special occasions that a locomotive is so fitted. One can be made quite easily from metal, wood or cardboard, and afterwards suitably painted. Methods of attachment to the locomotive will probably vary according to the fancy of the owner. (*Reply to D. Spiers, Brighton*).

COAL-STAGE.—An accessory of this type would be interesting, but we believe that most Hornby enthusiasts prefer to make one for themselves. In this way the stage may be made to suit the particular conditions of the miniature railway upon which it is installed. (*Reply to P. G. Lee, Knaresborough*).

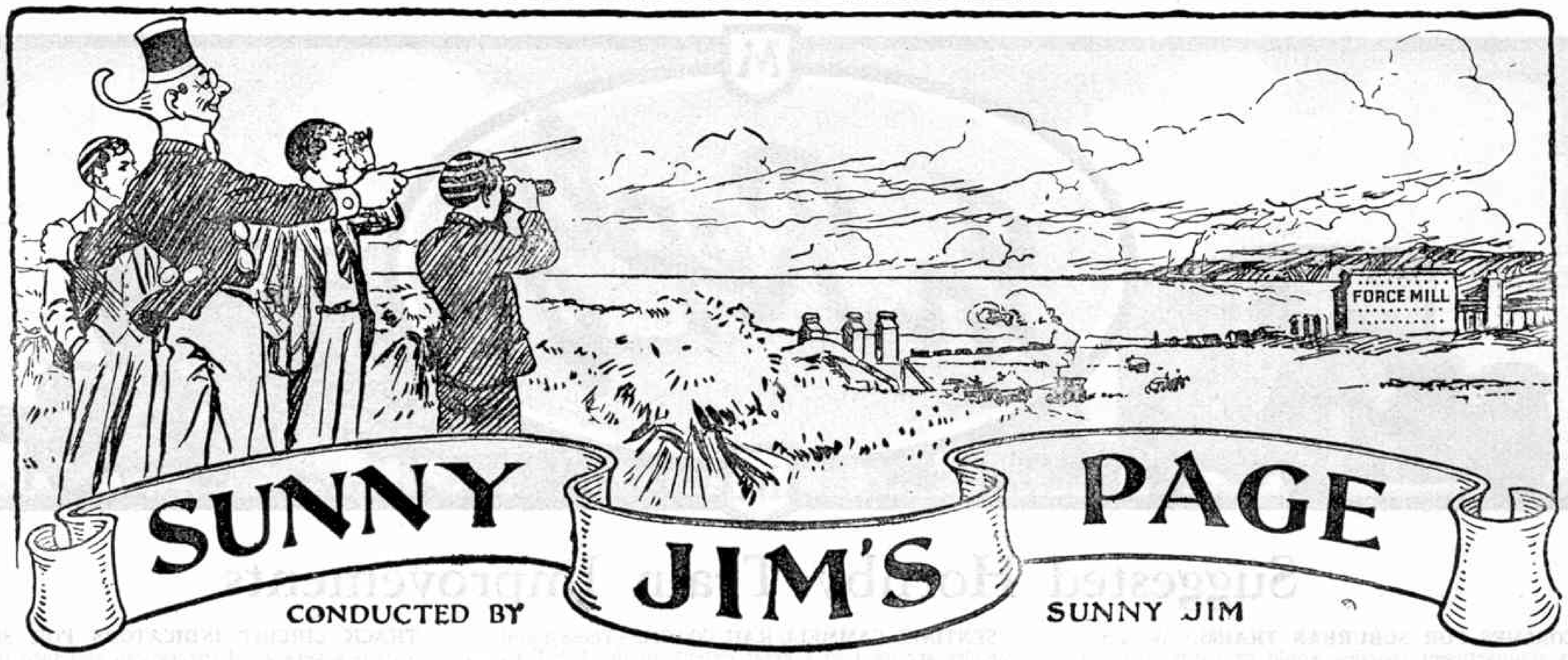
DOUBLE TRACK JUNCTION.—We have received many suggestions for various patterns of double track junctions. A junction of this type would form a desirable addition to the Hornby System and would enable full benefit to be obtained from the use of Hornby Double Track. We are giving attention to the question of its introduction and when a decision is reached full particulars will appear in the "*M.M.*" (*Reply to J. Gibson, Stirling*).

"SENTINEL" SHUNTING LOCOMOTIVE.—This is a very interesting and efficient type of locomotive, but it is not in sufficiently general use to be suitable for inclusion in the Hornby Series. For shunting operations we recommend the Hornby No. 1 Special Tank and the No. 1 Tank. (*Reply to R. Whitton, Bexhill-on-Sea*).

THREE-WAY JUNCTION SIGNAL.—This is a good idea, and will be considered for addition to our signal accessories. It frequently occurs that a three-way junction has to be included in a layout. (*Reply to J. Crawford, Tooting*).

LIGHTS IN HORNBY STATIONS.—There are various objections to manufacturing Hornby Stations fitted for electric lighting. An interesting and simple method of lighting stations was described on page 724 of the "*M.M.*" for September 1929. (*Reply to A. Farmer, Bolton, and others*).

FOUR-WHEELED WELL WAGON.—A wagon of this type would undoubtedly be more useful for smaller loads of bulky size than the existing bogie Trolley Wagon. We have not had any other enquiries for the introduction of such a wagon, but we will keep your suggestion in mind. (*Reply to N. Howden, York*).

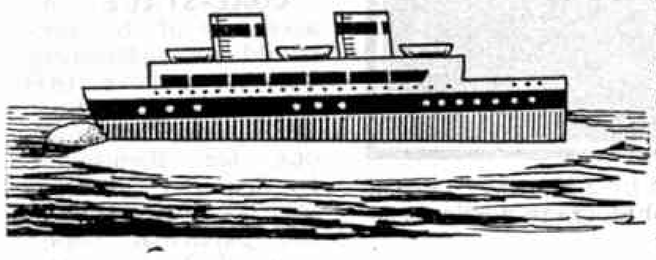


FORCEBOATS—Sunny Jim's New Game

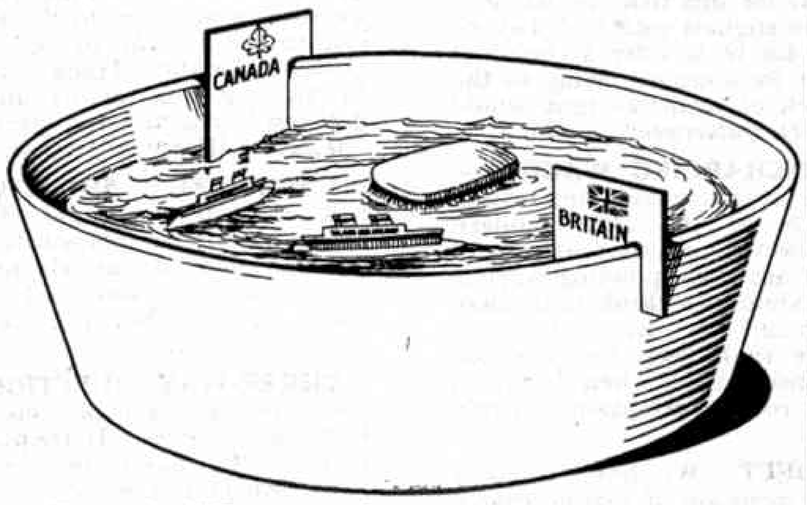
Paper Boats that move by themselves!

Here is a fine game! Boats driven by camphor, which move by themselves as soon as you put them in water. Take a piece of thin card or thick paper and cut out a shape of a boat as seen from above, about 2 inches long. Cut a V shaped notch in the stern and wedge in it a piece of camphor the size of a pea. Put the boat gently in a bath or basin of water (be careful not to let any water get on top) and it will cruise off on its own accord. The water must be perfectly clean or the boat will not work. You can clean it by passing a sheet of newspaper along the surface to collect any little specks of dirt or oil. If the water is slightly warm the boat will move faster.

The boat will look more real if you draw its side view on both sides of a piece of paper, cut it out, and stick it upright on the hull you have made, as in the illustration. Two or more of these boats can race round the tub, representing the big liners which carry cargoes of "FORCE" whole-wheat flakes from Canada to Britain. Make two "traps," as shown in the illustration, one marked "Canada" and the other "Britain," and start your boats from Canada. The first which gets itself safely trapped in "Britain" is the winner. A few islands (any small thing that floats will do) make the game more exciting, and the boats will move round them in a most realistic way. It is easy to imagine the way the cargoes of "FORCE" are unloaded at the Docks and hurried by road and rail to all parts of England.



Soon some of the "FORCE" is in a plate on your breakfast table. Fine and crunchy it is, too! And good for you! That's the stuff to build bone and muscle!



The little "Forceboats" sail around majestically.

If you would like to know more about this game write and ask me, and if you haven't tasted "FORCE" before (and even if you have) read the next column.

Yours forcefully,

Sunny Jim

Why Meccano Boys Should Eat "Force"

WHAT IS "GOOD FOOD?"

How are we going to know what food is good for us, and what food, although tempting in appearance, is of no use when eaten? It is quite an easy matter to serve up a meal that can be even luxurious, yet can be so arranged as to miss out some of the most important ingredients that are essential for life and health. Many of us now are eating food like this, yet do not realise the danger.

Good food is a diet that supplies all those things that are vital for the maintenance of good health. The right sort of food for boys will include cereals, milk, butter and cheese, vegetables and fruits. This diet would not debar such luxuries as doughnuts and pastries, but it would recommend their very sparing use, as there is little in them that is really good for one.

GOOD FOOD IS NICE FOOD.

"So, to be healthy, one must eat uninteresting food," you will think. Not so. The only things you are better off without, yet which taste nice, are pies and pastries made with white flour.

WHAT FLOUR LACKS.

White flour is wheat milled without the valuable bran coating it has when it comes from the wheatfield. This bran coating supplies many of those necessary mineral salts. It also prevents indigestion. Wheat is a cereal that has all the elements necessary to maintain vigorous health and strength, present in a proportion nearer to the ideal than in any other cereal. Wheat is the ideal food for man, but only when it is **whole** wheat. What we have to do is to find a way to prepare whole wheat for eating, yet make it taste as nice as the less nourishing pastries made with white flour. As you boys probably know, this has been done, and the result of years of work on this important subject is "Force" Food, which, to repeat an old slogan, supplies—"Vigour and Vim" because it is "the whole wheat, cooked, malted, flaked and toasted."

"FORCE" NEEDS NO COOKING.

"Force," quickly and easily served with hot milk (another ideal food complying with all the requirements necessary to produce perfect nutrition) cannot help but build up strong manly frames, and healthy virile bodies.

Most Meccano boys are already eaters of "Force." If you should be one of those who still has to know the delights of eating this wonderful food, do not delay a moment longer, but send to me for a free sample packet, and ask Mother to serve it with hot milk for breakfast. Once you try it you will want it always. Regular size packets are obtainable at all grocers.

Write to Sunny Jim at address below:

Sunny Jim (Dept. CB1),
197, Gt. Portland St., London, W.1.

Competition Page

Which were the Most Popular Covers in 1930?

The striking feature of our cover voting contests in past years has been the remarkable diversity of opinion disclosed by the voting and, in inviting our readers to record their favourite among the 1930 covers, we anticipate that there will be an even wider range of opinion. The 1930 covers have maintained such a striking level of merit that it is difficult to say that this, or that, was the best of the year, and we shall await the result of the contest with much interest.

For the benefit of new readers we must explain that in the above illustrations the splendid coloured covers that appeared on the various issues of the *"M.M."* during 1930 are displayed in a reduced form in their published order—January to June in the upper row, and July to December in the lower. The reproductions are intended for reference purposes only, but new readers will find them of great assistance in forming their judgment, although, of course, they convey no idea of the brilliancy of the colour of the originals. Those readers who possess copies of the 1930 issues or are able to obtain them, will be well advised to make their decision after a careful study of the originals.

Referring to each cover by its month of issue, each competitor is asked to write the following two things on a post card :—

A. The 1930 cover he likes best of all.
B. His idea of the order of popularity of the covers as decided by the massed vote of all the competitors.

This list must cover the whole year, every month being included. The name of the month must be given, not its number in the volume. Competitors need not place their own favourite cover at the head of list B, unless they believe that it will prove to be the choice of the remaining competitors. They should place it in the position in which they anticipate it will be placed by the massed vote.

The entrant's name and address must be added to the card, which should be addressed " Cover Voting Competition, Meccano Magazine, Binns Road, Old Swan, Liverpool." No competitor may submit more than one entry.

Prizes of Meccano products, to be chosen by the winners, to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors whose lists most accurately forecast the final result. In addition there will be a number of consolation prizes. In the event of a tie for any of the prizes, preference will be given to the entry displaying the neatest or most novel presentation. Closing date, 31st January. Overseas, 30th April.

New Year Resolutions

At the end of a year it is customary to review the past, and most of us, conscious of having done those things that would have been better left undone, determine that in future we will be firm and strong, and do only those things that are perfectly proper, and injurious to nobody—least of all ourselves! And, less than a week later, we find ourselves up to the old tricks!

This noble game is called " making New Year Resolutions " and very few of us really succeed in living up to our good intentions! But the best of people are likely to slip up in unusual circumstances and this month prizes are offered for the most humorous account of how a New Year Resolution was broken.

Entries should not exceed 500 words in length, and prizes of Meccano products—this includes Hornby Trains, of course—to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the four best entries, in order of merit. In addition there will be a number of consolation prizes.

Competitors must write on one side only of each sheet of paper used; the sheets should be fastened firmly together and sent to " Broken Resolutions, Meccano Magazine, Old Swan, Liverpool," and must reach this office not later than 31st January. Overseas, 30th April.

COMPETITION RESULTS

September Photo Contest.—First Prizes: Section A, C. Crocker (Letchworth, Herts.); Section B, W. T. Thornton (Basingstoke). Second Prizes: Section A, G. A. Wood (Leith); Section B, A. L. Northedge (Hull). Consolation Prizes: H. S. Bevans (Leicester); A. E. Davis (Boston, Lincs.); S. Ellerton (Crewe); J. Haylett (Loughton, Essex); L. Hope (Weston-super-Mare); G. M. Lane (Wakefield); R. J. McKay (Peterculter); T. B. Robson (Liverpool); H. H. Satterly (Ilford); K. Syers (Brondesbury, N.W.6).

31st Drawing Contest.—First Prizes: Section A, B. Crosby (Wrexham); Section B, L. W. Mitchell (Stockton-on-Tees). Second Prizes: Section A, H. H. G. Davis (Bristol); Section B, B. B. Primrose Hey (Glasgow). Third Prize (Special): Section A, R. D. Clark (Chatham).

Ad-Brands Contest.—1. A. Richardson (Leeds); 2. J. Corner (Newcastle-on-Tyne); 3. E. K. Barnes (New Longton); 4. W. H. Kimberley (Birmingham). Consolation Prizes: A. J. Davidson (Peebles); J. Stokes (Dublin); P. R. Stephens (Bristol); C. R. M. Coysh (Eltham, S.E.9); N. Tomlins (Worsley); F. J. Thompson (Liverpool); W. E. Grove (Fleetwood); J. Harvey (Birmingham); F. W. Byron (Nottingham); A. Robinson (Manchester); E. Wilson (Newcastle-on-Tyne); B. Crosby (Wrexham).

OVERSEAS

Cut-Outs No. 2.—First Prizes: Section A, M. P. Senji (Madras); Section B, Mrs. P. N. Senji (Madras); Second Prizes: Section A, A. C. F. Beck (Rotterdam); Section B, J. D. Siddons (Wainwright, Alberta).

July Photo Contest.—First Prizes: Section A, N. F. Keith (Sydney, N.S.W.); Section B, R. Thomas (Vancouver). Second Prizes: Section A, J. Credie (Cape Town); Section B, S. Leach (Toronto).

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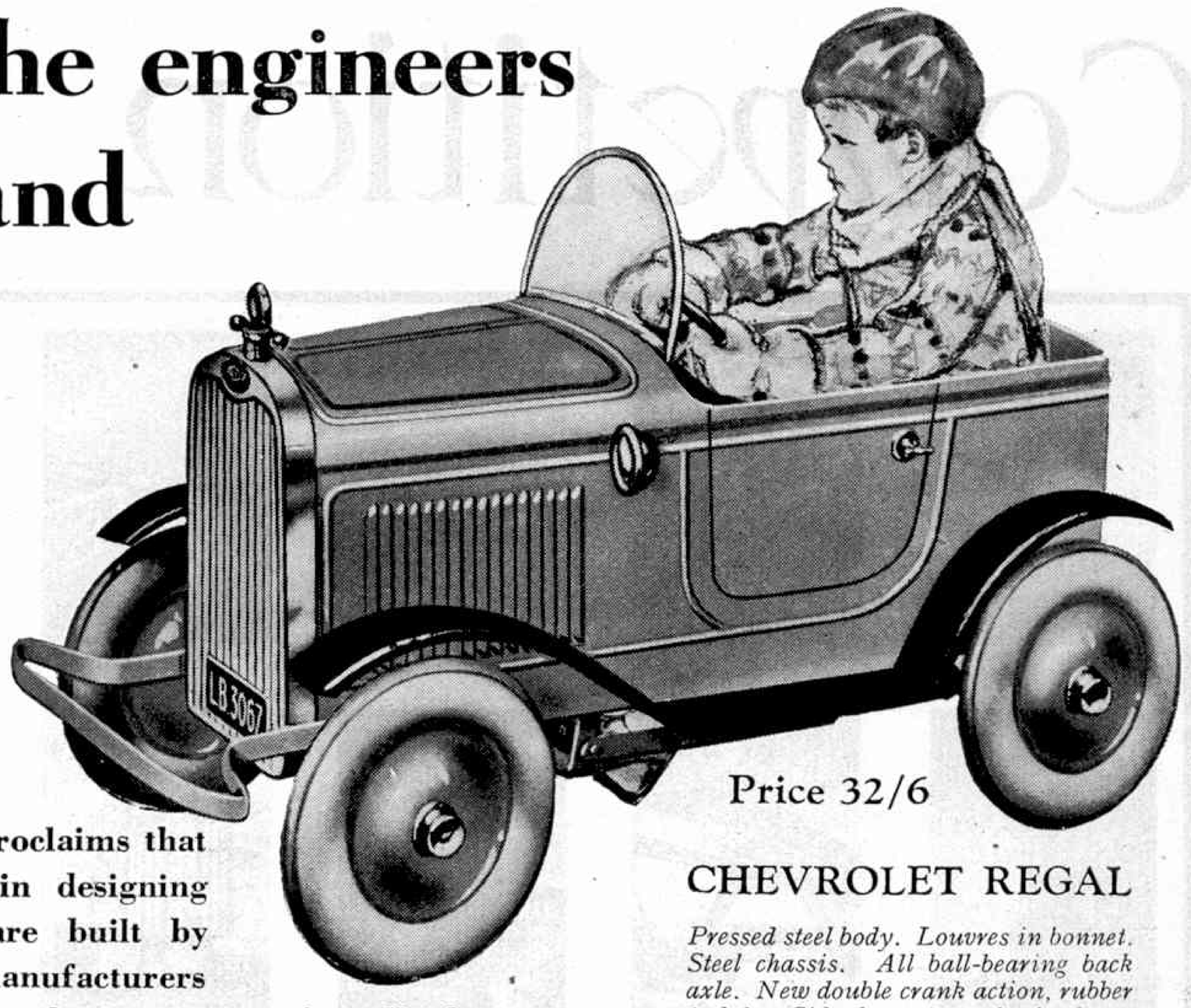

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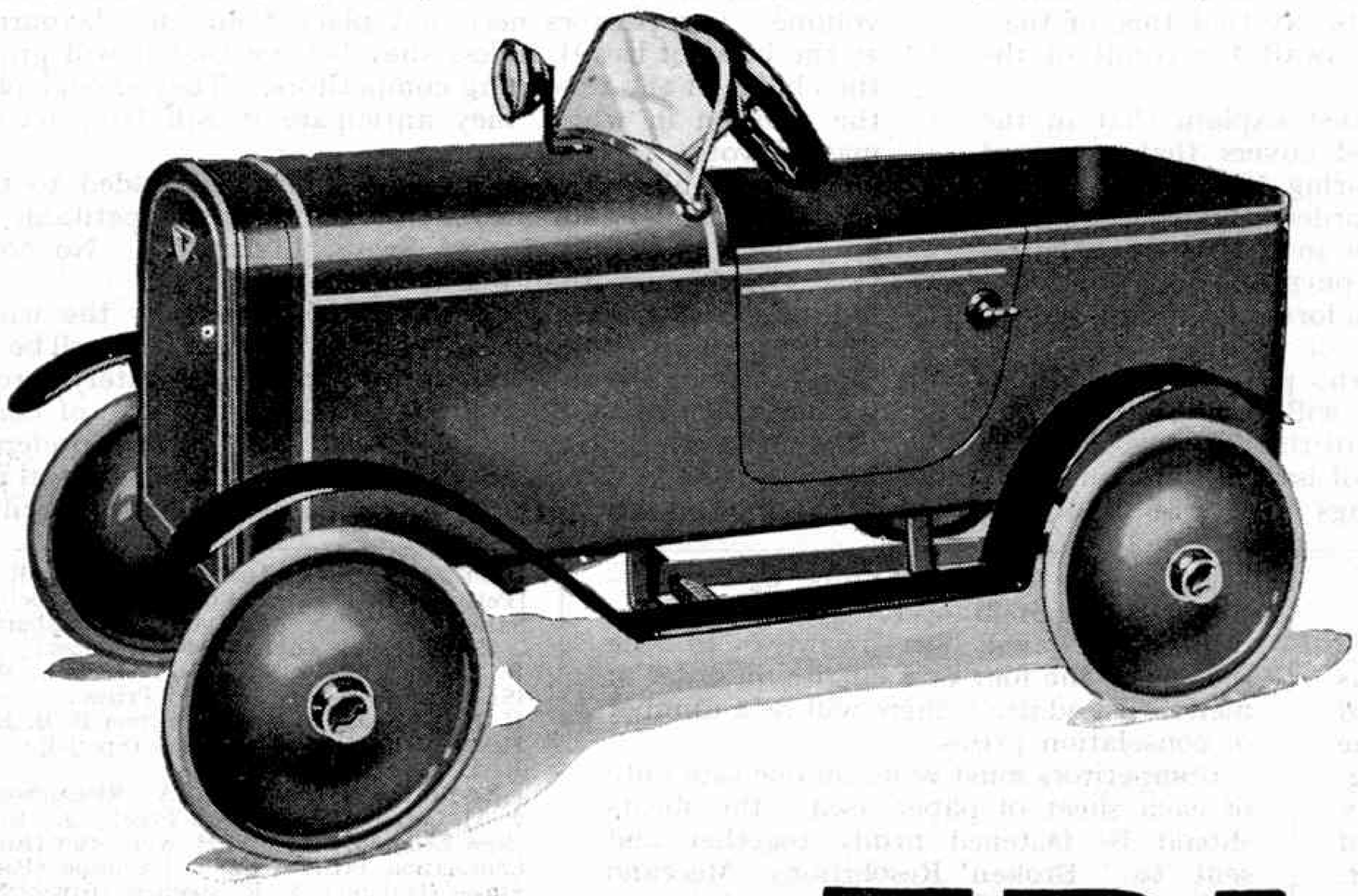

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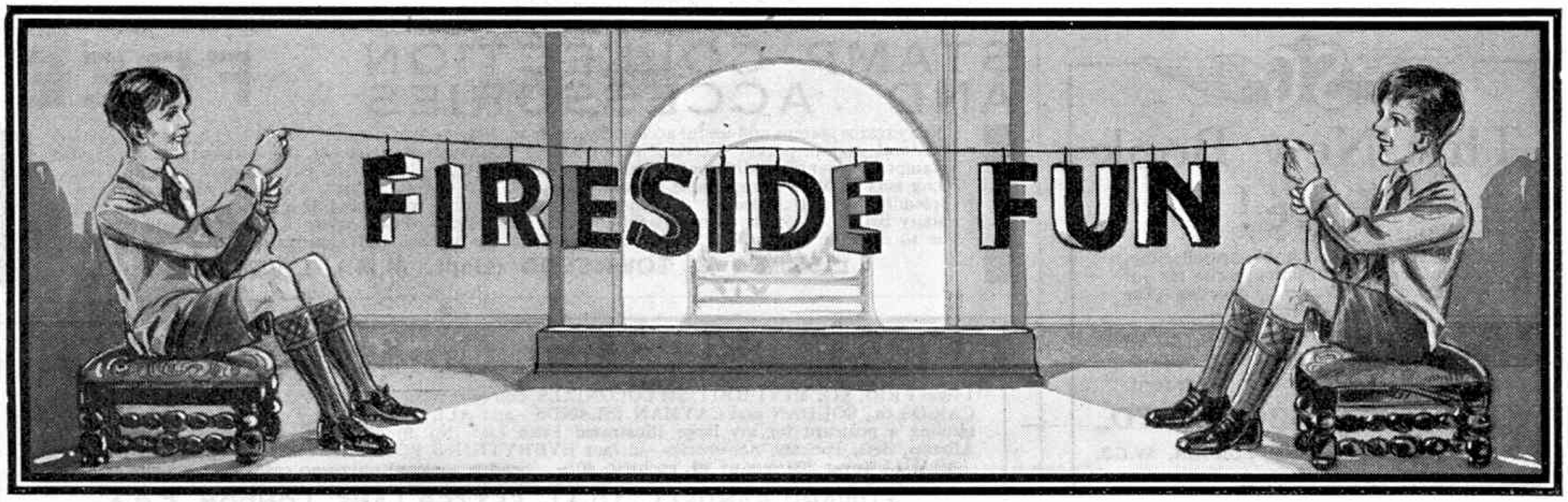


THE PLACE FOR A TRY

A conceited young man who was having singing lessons was continually worrying his tutor concerning his progress.

"Do you think I could use my voice in public now?" he asked one day.

"By all means," replied the tutor. "You can cheer as much as you like at a football match."

* * * *

Circus Hand: "Is it true that the lion's hair is falling out?"

Trainer: "Yes, that's his mane trouble."

* * * *

Jimmy had been stung by a nettle and after the first pain had died away, his face took on a look of perplexity.

"What are you thinking about, Jimmy," asked Mother.

"Well, Mother," came the reply, "if a wasp settled on a nettle, would the nettle sting the wasp or the wasp sting the nettle?"

* * * *

Mistress (to new Irish maid): "Why haven't you made the tea?"

Maid: "Sure an' there's none left in the caddy, Mum."

Mistress: "But why didn't you say so before?"

Maid: "There was some then."

* * * *

A little girl, aged nine, called her father to her bedside one evening.

"Papa," she said. "I want to ask your advice."

"Well, my dear, what is it about?"

"What do you think it will be best to give me on my birthday?"

* * * *

The student had been given the task of writing a verse in which the words "analyse" and "anatomy" occurred. After much thinking he triumphantly produced the following masterpiece:

My Anna lies over the ocean,
My Anna lies over the sea;
My Analyse over the ocean,
O bring back my Anatomy.

* * * *

Motor Car Salesman (desperately): "But, madam, if you take this car we will put your initials on it free of charge!"

Mrs. Jones: "But my husband says it's not the initial cost that counts, but the upkeep."

* * * *

Teacher: "If I said 'You was late at school to-day,' would that be right?"

Boy: "No, sir."

Teacher: "Why not?"

Boy: "Because I wasn't."

* * * *

A SPLENDID OPPORTUNITY

"I say," cried the young girl as she dashed into the village store, "father's being chased by a bull!

"Good heavens! What shall I do, miss?"

"Give me a roll of film for my camera, quick!"

AN OPEN THROTTLE

A professional singer was also a keen motorist. One day when driving his car through town he was held up in a traffic block. To while away the minutes the artiste began practising scales.

A taxi-driver, who had drawn up abreast listened intently for a time, then leaned forward and said: "Lummy, mister, there ain't 'arf something gone wrong wi' your exhaust!"

* * * *

HIS FIRST CHANCE

* * * *

Judge: "The two men were fighting with chairs. Didn't you try to establish peace?"

Witness: "No, there was not a third chair handy.'

* * * *

Entertainer (in small music hall): "If any lady or gentleman in the audience will call out the name of some female character in Shakespeare, I will endeavour to portray that character."

Voice from the Gallery: "Florence Nightingale."

The Entertainer: "I said Shakespeare, sir, not Dickens."

* * * *

Mrs. Knulywed was shopping in a big store.

"Are you quite sure I shall get some big, strong trees from these seeds?" she said.

"Yes, mam," replied the salesman; "I can guarantee them."

"In that case," replied the young lady, "I will take a hammock as well."

* * * *

"I had a three-hour interview with a Russian this morning, yet I know not a word of Russian."

"Wonderful! Did you manage by signs?"

"No; he spoke English fluently."

* * * *

A Scotchman in planning his new home left the roof off one room.

A friend asked the reason for this.

"Oh, that's the shower," replied the Scotchman.

* * * *

Thomas, the traveller, was nothing if not truthful.

"Were you quite cool when that lion appeared before you?" he was asked.

"Cool?" he echoed. "So much so that my teeth just chattered."

* * * *

"How are you getting on at the University now?"

"Oh, pretty well, thanks. I'm trying awfully hard to get ahead."

"That's good, you certainly do need one."

BUTTERFINGERS!

Stationmaster (rushing out of office on hearing crash): "What's the matter, porter?"

Porter: "A passenger got here just as the 2.10 was leaving, sir."

Stationmaster: "Did he catch it?"

Porter: "Yes, but he couldn't hold it."

* * * *

"What are you running for?"

"I'm trying to catch my breath."

* * * *

Customer (to barber): "Did you like the new vicar's sermon on Sunday?"

Barber: "Well, really sir, there was a gentleman sitting in front of me whose hair was parted so crookedly that I was too disturbed to hear a word of what the vicar was saying!"

* * * *

"What's grape fruit?"

"Strictly speaking it's a lemon that's been given a chance and taken advantage of it."

* * * *

Father was taking the family to see the village where he had spent his boyhood.

"Oh!" he exclaimed in a shocked tone as the train approached the station, "there's only one windmill now. I wonder what they have done with the other?"

"I expect, Daddie," said little Mary, "there wasn't enough wind for two, so they had to pull the other down."

* * * *

The train made its way very slowly through the hills. It seemed as though there were no need for hurry.

"Is this train ever on time?" queried a stranger of a fellow-passenger.

"They don't worry much about being on time," was the reply. "They're satisfied if it's on the track."

* * * *

Teacher: "Can anyone tell me what dust is?"

Tommy: "Please, sir, mud, with the juice squeezed out of it."

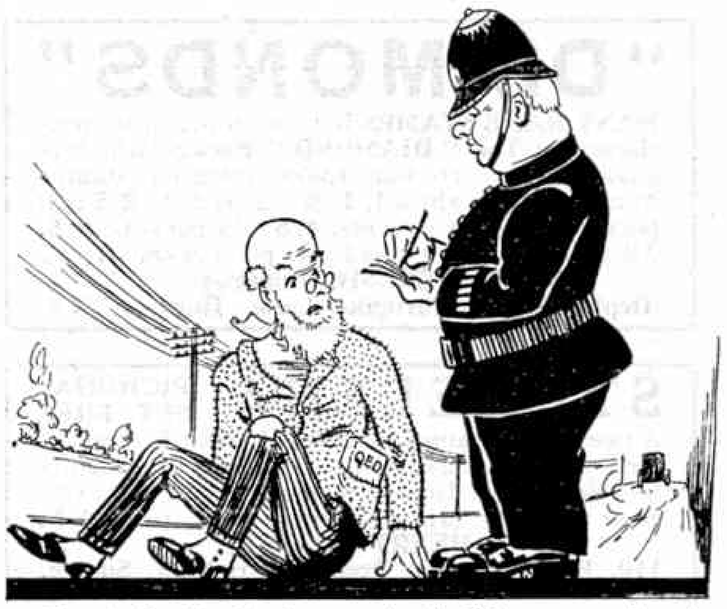
* * * *

A school teacher encountered difficulties with her new car on arrival at a busy crossing. Somewhat flurried, she descended to investigate the mysteries within the bonnet, and as she did so the policeman on point duty raised his hand as a signal to traffic.

"Put your hand down," she said irritably. "I'm far too busy to attend to you now!"

* * * *

A TASK FOR SCOTLAND YARD



Constable (to Professor who had been run down): "Did you chance to notice the number of the car, sir?"

Professor: "Well, not exactly, but I remember noticing that if it was doubled and then multiplied by itself, the square root of the product was the original number with the integers reversed."

SG

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If you are interested in stamp-collecting, or want to start collecting, write for our FREE book, **Stamp Collecting—The World's Hobby.**

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Mention 1931 offer.

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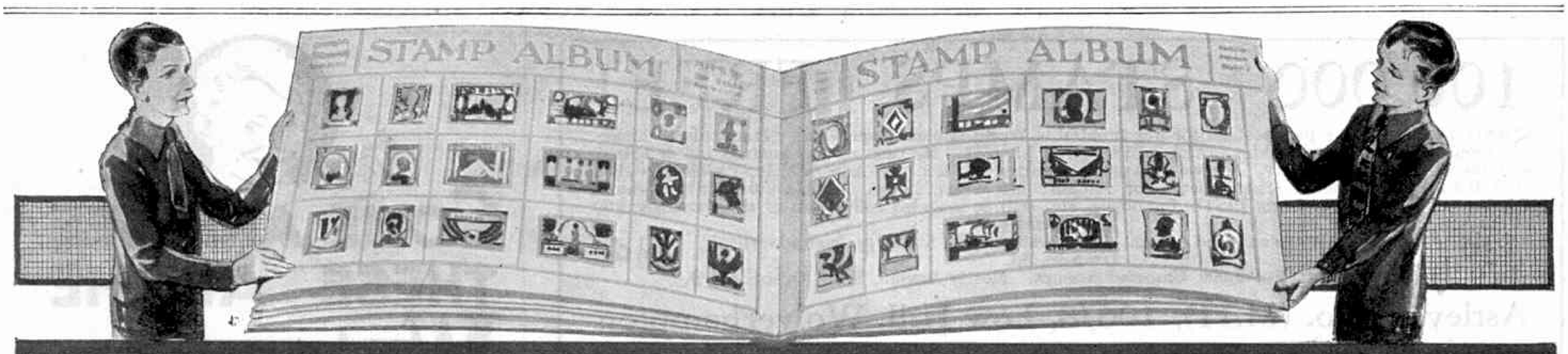

STAMP COLLECTING

STARTING STAMP COLLECTING

STAMP albums and packets of stamps have ever been popular presents for schoolboys, and because very many of our readers will have taken up the hobby during the past few weeks, it is seasonable to devote some space this month to dealing with the problems and perplexities that beset the new collector in his early experiences.

10 lepta Greek Independence Centenary Commemorative. Issued in 1930.

We will suppose that an album has already been secured. The question then arises, what is to be put into it? There are so many types of stamps that are not purely postal varieties, that it is well to make a decision immediately that certain types may go in and others must be kept out. The stamps for which room certainly should be found are those used or intended for postal purposes, including commemorative, charity and air mail stamps, and revenue stamps specifically authorised for postal use, and also probably, postage dues. Purely revenue stamps—known as fiscals—telegraph stamps, and unofficial issues, such as those of Lundy Island, should not be included. It would be a good plan to secure a second smaller album in which to keep the items excluded from the general album, for, although these have no standing from a stamp collecting viewpoint, many of them may be of real interest in themselves.

The next question is: how are they to be put in? There is only one answer: by employing the best stamp hinges or mounts, that can be peeled off the stamps or album pages without causing damage. The best mounts cost only 6d. to 9d. per 1,000, and their extra cost will be saved dozens of times over. They are really an economy.

In using the mounts they should be folded over a quarter of an inch from one end and the short end fixed as close to the top of the stamp as possible, without allowing it to show, of course. This plan enables the stamps to be turned for examination of the watermarks without removing them from the album.

Now as to the actual arrangement of the stamps. It is well to remember that the manner of display of a collection is one of its most important features, and a collection of moderate and cheap items, set out attractively, will often prove far more interesting than an equal quantity of good stamps laid out regardless of order.

It is not difficult to be neat, and the album with ruled spaces lends itself to neat display almost as readily as the loose leaf album with its blank pages. For example, let it be supposed that a set of nine stamps is to be mounted in an album with seven spaces to the line. The set requires at least two lines, and if conservation of space is important, the best arrangement would be five in the upper row and four in the lower, each row being spaced evenly from the edge of the page. If three lines are available then the arrangement might be three, four and two, or four, two and three. Some sort of pattern should be aimed at and the less frequently the individual pattern recurs on different pages, the better will the album look. In laying out a set that is not quite complete, positions should be arranged for the missing stamps. Incidentally, it may be remarked that there is more fun in hunting for a stamp that is required to complete a design, than for one that is destined merely to fill one of several rows of a page.

Many difficulties will be encountered in deciding the order in which stamps of many series should appear, and this is particularly the case with certain British issues. For example, Australia has issued penny stamps, bearing the King's head design, in three different colours—red, violet and green. How is the new collector to know the order in which these stamps should be placed in his album?

His salvation will be a good up-to-date stamp catalogue—such as the Whitfield King or Stanley Gibbons. These provide the answer to every problem likely to be encountered. A good catalogue may be described as the "mariner's compass of philately." Without it one may accumulate stamps, but one cannot collect intelligently.

Turkish 6 Grouch general issue of 1926, overprinted to commemorate the Smyrna Exhibition, 1927.

The possession of a catalogue is not an "open sesame" to all the delights of stamp collecting, however. The collector must know how to recognise the things the catalogue records, watermarks, perforations, overprints, surcharges and so on. These are matters affecting principally the advanced collector, but it is very desirable that the novice should know the rudiments of their importance.

Swiss 20 cents Pro Juventute Charity stamp of 1929.

Most new stamp collectors know that the paper on which stamps are printed, usually—although not always—bears in its texture a design of some kind. This may be a crown, or certain letters, or perhaps a series of wavy lines. It is called the watermark, and its main purpose is to provide a ready means of identifying genuine stamps and thus to prevent the circulation of unauthorised or forged issues.

Perforations arise from the process of preparing individual stamps for separation. Tiny holes are punched around the stamps, and the measure of the perforation is the number of such holes appearing in a length of two centimetres. The measurement always quotes the top of the stamp first and then the sides. Some stamps are rouletted: that is to say, they are separated by tiny cuts instead of holes. There are also "imperforate" stamps, stamps that can be separated only by cutting.

Surcharges and overprints are among the most interesting things in stamp collecting. One hears the terms applied very loosely by many young collectors however, and therefore it is well to be clear that overprints alter or supplement the function for which the stamp was issued originally; surcharges affect only the face value of a stamp—not its purpose.

German 2 mark Air Mail stamp, issued in 1928 for use on the trans-Atlantic flight of the Graf Zeppelin.

There is not space this month to deal with all the many interesting points that the beginner desires to know, and we will deal with others as opportunity serves. Next month we will discuss the financial side of stamp collecting.

In the meantime, we extend to our readers an invitation to write to us whenever they are in doubt or difficulty in stamp collecting matters. There are many occasions when young collectors need advice and we shall be very pleased to give assistance to beginners in order to enable them to avoid the pitfalls of their new hobby.

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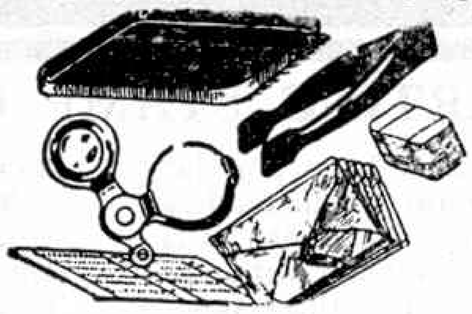
Contained in the **Free Casket** are the well-known Matlock Tweezers (with spade ends), Crystal Clear Envelopes, Marvellous **Matlock** Mounts and a **Fine Set of Four Rare Siam** (a gift in themselves!). The Handsome Metal Gift Casket has Hinged Lid, showing in colour **The Highest English Precipice** at Matlock—The Home of Philately! It also combines in a unique way a **Watermark Detector** and an **Accurate All-Metal Perforation Gauge.** Send only 3d. postage, or if you would like a **Powerful Magnifying Glass to be included in the Casket, 4d.** in all must be sent. **Ask for Approvals.**



VICTOR BANCROFT, MATLOCK, ENGLAND.

TWO NEW YEAR GIFTS

50 ROUMANIA, 50 FRENCH COLS., 30 FINLAND, 50 DANZIG, 38 GERMAN PROVS., 9 ROUMANIA BOY KING MICHAEL. Genuine Approval Applicants send postage and ask for two of these sets free.

L. BASSINGTHWAIGHTE,
41, DEREHAM ROAD, NORWICH.

NOTHING FREE!

Except our 1931 Price List of Packets and Sets. Send for this and buy your requirements at lowest market prices.

Special offer: Roumania Boy King "8 Junie 1930" overprint, Set of 7, 25 bani-5 leu, Price **9d.** Postage Extra.

These are far scarcer than the unoverprinted series.

THE MIDLAND STAMP CO. LTD.,
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FREE!

To all genuine approval applicants we will send a complete collector's outfit comprising Metal Watermark Detector, Transparent Envelopes, Perforation Gauge, Mounts and a grand Packet of Fifty Stamps from FIFTY COUNTRIES, including scarce Greenland. Enclose 1½d. postage.

E. WAY, 5, MORETON GROVE, WALLASEY, CHESH.

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Huge discount of 8d. in 1/- allowed, or 9d. in 1/- for a nett purchase of 2/6 or more. My approvals being **absolutely the cheapest and best, no free gifts** are given.

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I am offering 125 different Stamps to genuine applicants who request to see my British Colonial Approval Books of picked copies priced from ½d. each (less 25% discount). This fine packet includes Spanish "Goya," Greece 1930, and many British and French Colonial Pictorials.

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Packet of Stamp Mounts.
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Just ask to see my famous Approvals, and enclose 2d. for postage, etc., and receive this wonderful Gift FREE.

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Fine set of 9
JAMAICA used, ½d. to 1/- **PICTORIALS**
Price **7d.**

ROUMANIA, BOY KING, set of 9 used, for **6d.**
NORTHERN MONGOLIA, 1927, 5 pictorials **5d.**
NYASSA, comp. set of 9 **TRIANGULARS,** mint **8d.**
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HOLLAND, 1927 Charity comp., used set for **7d.**

Please write for my **PRICE LIST** just issued, offering many similar sets to the above.

HAROLD STROUD,
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STAMP FREE! WALLET

Fine Pocket Case fitted with linen shelves for Stamps, Perforation Gauge, etc., containing fine **MINT CENTRAL AMERICAN STAMP CATALOGUED 7/6,** gratis to applicants for my famous **"BETTA" STAMP APPROVALS** (4d. in 1/- Bonus to buyers) sending 3d. postage and packing only (Abroad 6d.). Finest Selection at Lowest Prices.

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OFFER TO MECCANO READERS

118	**German** provisionals	**6d.**
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4	**Persia :** "Coronation" 4 high values, cat. 30/-	**1/6**
13	**Italy :** "Historical" series, used	**6d.**
18	**Nyassa :** Pictorial Issue	**2/6**
5	**Liberia :** Pictorial Centenary issue, used ...	**9d.**
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500	all different ... **2/6** 1,000 all different ...	**5/-**

Ask for our new list and approval selection.

WATSON & BUTTERS LTD.,
102, Charing Cross Road, LONDON, W.C.2.

MINT COLONIALS

Add to your collection by sending to us for our Special Offer of 6 Unused Pictorial Colonials which consists of 2 Barbadoes, Tanganyika (Giraffe), Bermuda (Ship), and interesting Stamps from Nauru and Cayman Islands. This offer is only 3d. post free to applicants for our famous approval sheets.

CHARLESWORTH & HALL,
34, ARUNDEL ROAD, ANSDELL, LYTHAM.

1000 DIFFERENT STAMPS 1000

ON APPROVAL

from which you may select any 100 for 3/-. This selection is **not** made up of the thousand commonest stamps, but contains specimens priced by Stanley Gibbons up to 1/- each. For 3/- you have the opportunity of choosing 100 stamps of the catalogue value of 20/- or more.

H. HARDY, 285, Archway Road, London, N.6.

1,000 STAMPS, all different, a splendid start for a collection. Price only **3/6. STAMP ALBUMS** at various prices from **1/-** to **40/-**. Send for our illustrated list sent post free to any address. **FOR 50 YEARS** we have been sending out sheets of Stamps on approval. Every Stamp we sell is fully guaranteed, is specially selected and priced at the lowest possible figure. Ask for some to be sent you for inspection. For 30 days (abroad 90 days), we will present **absolutely free,** to all applicants enclosing 1½d. for postage, a set of 4 Trinidad and Tobago Stamps if the application is addressed

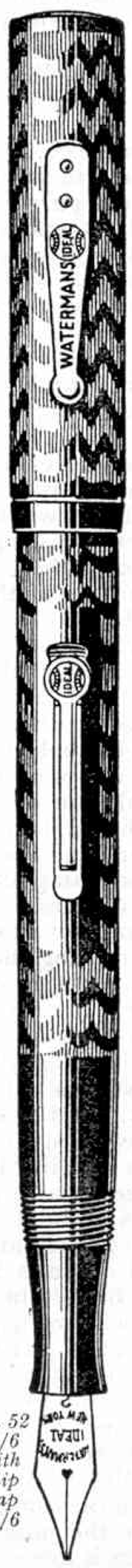
ERRINGTON & MARTIN (Department 83),
South Hackney, London, E.9. *Established 1880.*

COME AND SEE THESE AT THE Waterman

STAND No. 34

(FIRST FLOOR)

DAILY MAIL SCHOOLBOYS' EXHIBITION *EMPIRE HALL, OLYMPIA. JANUARY 1st.-10th.*



Make a special point of seeing these at the Waterman STAND.

1. Cricket Bats, Football, etc., showing autographs of many famous players.
2. Photo postcard of Jack Hobbs (free copies while supply lasts).
3. Photo postcards of Cherry Kearton in an interesting scene, reproduced from his wonderful film "DASSAN." Free on request.
4. Large scale model of the Waterman factory at Montreal.
5. The latest designs and styles of Waterman's Pens, Pencils, Writing Sets and Desk Stands, Inks, etc.

If unable to visit Olympia, write for copies of the Jack Hobbs and Cherry Kearton photo prints, also a copy of the New Pen Book.

L. G. SLOAN LTD.

The Pen Corner,

Kingsway, London, W.C.2.

Always use Waterman's Ideal Ink.

No. 52 17/6 with Clip Cap 18/6

For further stamp advertisements, see page 93

Stamp Gossip

and Notes on New Issues

Astronomy on Stamps

The design of Uruguay's current air mail issue has the interesting distinction of being the first accurate star map to find its way into the stamp album. The main feature of the stamp as our illustration shows, is the mythological winged horse,

Pegasus, and, in the background, a starry sky.

Careful examination of the arrangement of the stars shows that it is an accurate representation of the constellation *Pegasus,* that is so prominent a feature in the southern skies at night toward the end of the British summer.

At first sight the constellation seems to be inverted. The explanation is that when seen from Uruguay and elsewhere in the Southern Hemisphere, "*Pegasus*" is inverted as compared with the view from the Northern Hemisphere. Thus the stamp gives the correct configuration as seen from Uruguay.

Danish Royal Birthday Stamps

Denmark has celebrated the 60th birthday of King Christian X with a special series of commemorative stamps. The design illustrated here is common to each of the 10 values in the set, ranging from 5 to 40 öre.

Changes in Canadian Design

The designs of the higher value Canadian issues are now in progress of being changed, and the splendid Quebec Bridge and International Fishery race designs are to become obsolete. However fine the new designs may be—and early reports place them as splendid specimens—the end of the present series is to be regretted. It marked an epoch in Canadian stamp history.

The first of the new stamps is the 10c. illustrated here, showing a view of the Parliamentary Library at Ottawa. Other new designs that will appear in due course are as follows: 12c., Citadel at Quebec; 50c., Church at Grand Pré, Nova Scotia; $1, Mount Edith Cavell, in the Canadian Rockies; and, on the 5c. air mail, Mercury in front of a Globe.

Spanish Columbus Issue

In one further merry burst of activity, Spain has cast upon the philatelic market a series of Columbus commemoratives. Thus Columbus has come into his own at last; most of the South American States have introduced him upon their stamps, but hitherto he has been ignored on those of the country from which he sailed westward to discover the New World.

The new series is very extensive, for it contains no fewer than 35 stamps in 12 designs. These comprise one issue for general purposes, another for European air mail, and a third for air mail correspondence with America.

Several of the stamps show portraits of Columbus, and views of his flagship the *Santa Maria,* but the portraits of the commanders of the auxiliary ships *Nina* and *Pinta* are new to the philatelic portrait gallery. These ships were commanded respectively by the brothers Vincente Pinzan (30c. and 50c.) and Martin Pinzan (25c., 40c. and 1p.), whose portraits appear separately on the European air mail values indicated with their names, and in company with that of Columbus on the 4p. and 10p. Spanish American air mail values.

The lower values of the general series give two excellent views of the *Santa Maria,* and a triangular design (25c., 40c., and 1p.) in the higher values of this series, shows a view of the full fleet.

Fresh ground is broken also with a view of the Monastery of Santa Maria de la Rabida at Palos (5c. and 10c. values Spanish-American air mail series). This was Columbus' refuge on his first arrival in Spain, and it was the encouragement given by the Franciscan monks that revived his enthusiasm for his projected voyages of discovery.

This, the last of the many Spanish commemoratives of recent days, will be forgiven, for it is a reminder of the most outstanding event in Spanish history.

Its principal purpose is to mark the closing of the Seville-Barcelona Exhibition.

Roumania's New Issues

The expected Roumanian issues bearing the portrait of the new King, Charles II, have now made their appearance, in two separate sets for air mail and general purposes respectively. The portrait design we illustrate is used for each of the air mail stamps, and the same portrait is used for two designs in the general issue, the framing only varying. The third design in the general issue is a quite different portrait, showing the King bareheaded and facing in the opposite direction.

The general issue comprises 11 values, 25c. to 20L., and the air mail series contains four stamps, 1, 2, 5 and 10L, all in photogravure.

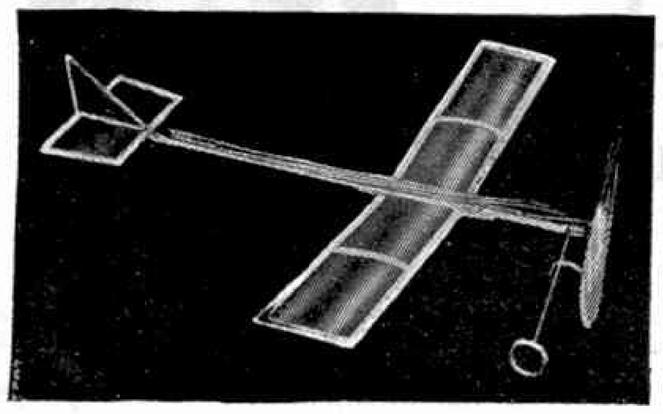
New Engineering Issues

An interesting addition to the list of engineering stamps has been made by the Irish Free State with a commemorative in celebration of the completion of the River Shannon electric power scheme. We illustrate the stamp, which is a 2d. denomination. The design shows a portion of the barrage and intake station at Parteen Villa near Ardnacrusha.

Albania contributes a bridge stamp in its new issue in commemoration of the second anniversary of the accession of King Zogu I. This issue consists of 11 stamps ranging in value from 1 qind to 5 fr., and employs four designs, a portrait of the King and three pictorials, one of which includes an excellent, though long-distance, view of the three-arched bridge that carries the Scutari-Alessio railway over the River Boyana.

WARNEFORD MODELS

BUILT TO FLY WELL!



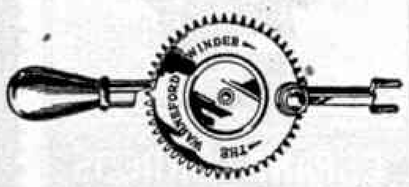
THE "MOTH" TRACTOR. *Price* 4/6

Length 19 in., span 18½ in., fitted patent double bearing and shock-proof chassis, 8 in. hand-carved and balanced propeller, covered red proofed silk. A splendid flyer, and beautifully finished, this model at the price is undoubtedly the finest value ever offered. (Patent No. 296946).

THE "SWIFT" TRACTOR. *Price* 10/6

Length 30 in., span 26½ in., fitted 11 in. hand-carved and balanced propeller. Patent double bearing and shock-proof chassis. Covered yellow proofed silk with identification discs. A long and very steady flight is obtainable with this model, and though of large dimensions is very easy to handle. (Patent No. 296946).

USE "RUBERLUE" (Doubles the Flight) 6d. TUBE



THE WARNEFORD WINDER.

Universal Fitting for all Warneford Models. Price 2/6.

SCHOOLBOYS' EXHIBITION

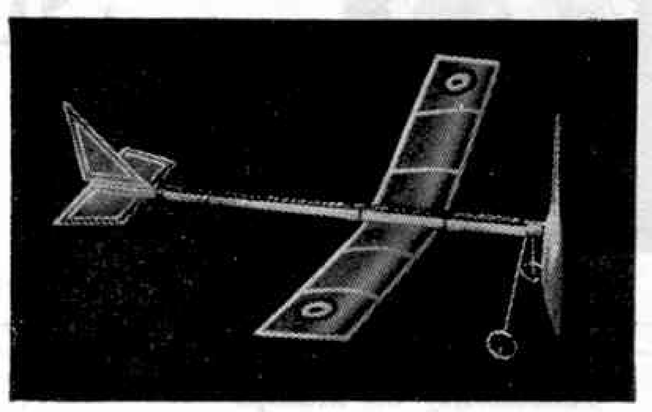
Jan. 1st to Jan. 10th.

Every visitor will be interested in this announcement.

A fine series of lectures are being given by the makers of Warneford Aeroplanes, at the above Exhibition, dealing with design, construction, performance, and everything appertaining to both the model and the real aeroplane.

Our Technical Expert will be in attendance and will be pleased to answer any questions you may wish to ask.

Spare Parts for Warneford Aeroplanes may be obtained from all good stores and toy shops. If you have any difficulty in obtaining your requirements write to the manufacturers for name of nearest stockist.



THE "DEMON" TRACTOR. *Price* 7/6

Length 25½ in., span 23 in. Fitted 10 in. hand-carved and balanced propeller, patent double-bearing and shock-proof chassis, covered yellow proofed silk with identification discs. Weight and wind resistance are reduced to a minimum in this model, giving the utmost duration of flight. (Patent No. 296946).

THE "WIZARD" CONSTRUCTION SET.

Low Wing. Full Cantilever Monoplane.

Builds a replica of machine that won the Sir Charles Wakefield International Cup (1929) and the S.M.A.E. Freshmen's Competition (1930).

Speed 16 m.p.h. Ceiling 120 ft. Glide 1 in 10. Landing speed 14 m.p.h. Length 32 in. Span 48 in. Weight 10 oz.

Full set of parts with full-size working drawings and complete instruction book. Packed in strong leather board box. Price **35/-**

SOLE MANUFACTURERS: F. J. MEE, GREENWICH, LONDON, S.E.10. PRICE LIST POST FREE.

GAMAGES

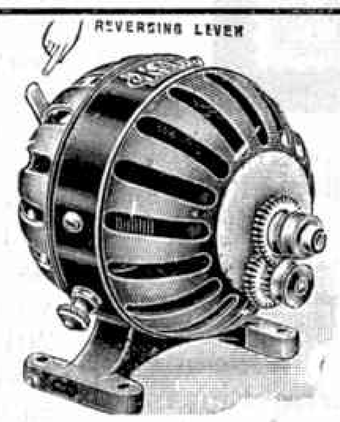
THE BOYS' OWN STORE

NOW READY

NEW EDITION OF

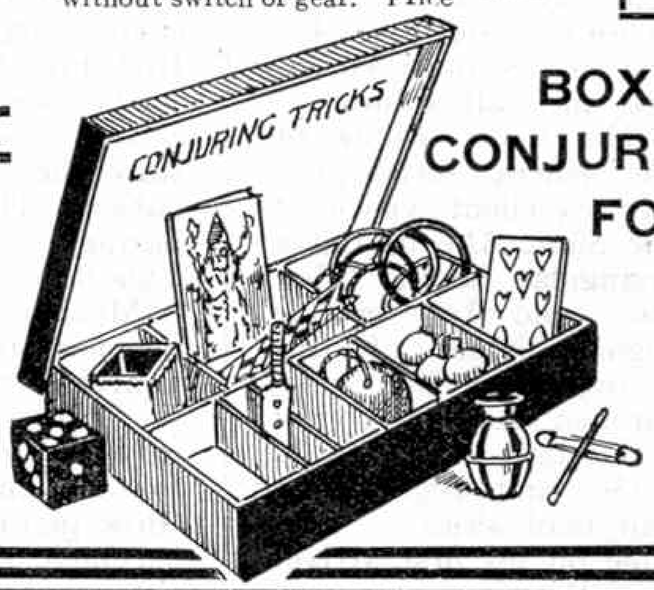
GAMAGES GIANT TOY & MODEL CATALOGUE

Start the New Year well by sending for this Giant book of Toys, Models, Games, Hobbies, etc. It is bigger than ever, and contains a mine of ideas and suggestions for hobbies.



ELECTRIC MOTOR

High quality with start, stop, and reverse switch and speed reduction gear 21/-. Ditto without switch or gear. Price **15/-**



BOXES OF CONJURING TRICKS FOR BOYS

The finest sets obtainable at the price. Full instructions in every box.

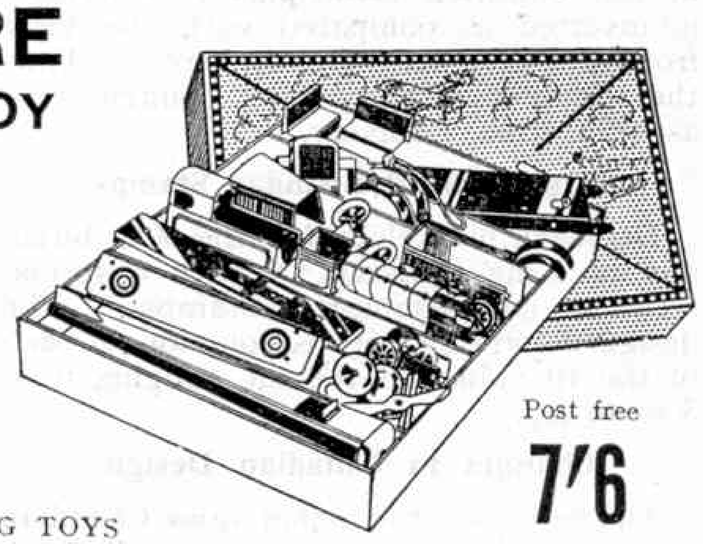
Post 4d. Price **3/-**

Post 5d. Price **4/6**

"UBILDA" TOY SET

contains parts to build:
A MECHANICAL CAR (9 ins. long).
A METAL AEROPLANE (13½ ins. long).
A MECHANICAL LOCOMOTIVE (10 ins. long).

The parts are packed as illustrated, in a strong box 21 × 14 × 2 ins.
EXCEPTIONALLY STRONG TOYS (Made in England).



Post free **7/6**

THE FAMOUS "DIANA" AIR GUN

BREECH LOADING

A first class gun at a modest price. It will give you heaps of good sport. Price **10/9**

Post 9d. Slugs 9d. 1,000. Darts 6d. dozen.

We stock all Hornby Train and Meccano Parts and send them Carriage Paid to any Station U.K.

Gamages, Holborn, London, E.C.1. *City Branch: 107, Cheapside, E.C.2.*

Famous Aero Engines—(*Continued from page 35*)

7.6 gallons per hour when flying at normal speed, while the oil consumption is one pint per hour.

The inverted "Hermes" Mark IIB retains all the well-known "Cirrus" characteristics, and also incorporates many improvements. Apart from the crankcase, however, the principal component parts are interchangeable with the "Hermes" Mark II. In the inverted engine the lower portion of the crankcase is an aluminium alloy casting. It houses the main bearings and carries the timing gears at the rear end. As this engine is lubricated on the dry sump principle, the upper half of the crankcase, which is made of electron metal, merely acts as a cover for the moving parts.

The lubrication system of the "Hermes" Mark IIB provides for the oil to be pressure fed from the oil tank by means of a delivery pump. A scavenger pump is also fitted.

The inverted engine has an overall length of 42.4 in. and a height of 29.09 in. The width between engine bearer bolt centres is 18.82 in. The output and fuel and oil consumptions of the inverted engine are identical with those of the ordinary Mark II.

It is interesting to note that the new "Cirrus Hermes" engines were as successful as their three predecessors in passing the Air Ministry standard type tests at their first attempts.

New Meccano Models—(*Continued from page 53*)

Rod 4 and connected pivotally to the jib by means of 4½" Strips 5. A 57-teeth Gear on the Rod 4 meshes with a Worm attached to a Crank Handle, which is journalled in a 2½" × 1" Double Angle Strip, indicated by the two Bolts A, and a 2½" Strip situated at the rear end of the gear box.

In order to build this model the following parts will be required :—15 of No. 2 ; 8 of No. 2a ; 6 of No. 3 ; 5 of No. 4 ; 15 of No. 5 ; 4 of No. 6a ; 4 of No. 7 ; 2 of No. 8 ; 17 of No. 9 ; 2 of No. 9b ; 4 of No. 10 ; 1 of No. 14 ; 2 of No. 15 ; 1 of No. 16 ; 1 of No. 16a ; 1 of No. 16b ; 2 of No. 17 ; 1 of No. 18a ; 1 of No. 19 ; 3 of No. 19b ; 2 of No. 21 ; 1 of No. 22 ; 3 of No. 22a ; 3 of No. 24 ; 1 of No. 26 ; 2 of No. 27a ; 1 of No. 28 ; 2 of No. 32 ; 138 of No. 37 ; 4 of No. 37a ; 12 of No. 38 ; 1 of No. 40 ; 1 of No. 46 ; 1 of No. 48a ; 3 of No. 52 ; 1 of No. 57b ; 22 of No. 59 ; 3 of No. 62 ; 1 of No. 63 ; 2 of No. 70 ; 2 of No. 77 ; 1 of No. 111 ; 4 of No. 111c ; 2 of No. 115 ; 21 of No. 117 ; 6 of No. 133 ; 1 of No. 137.

Books You Need

The Boy Electrician

enables you to construct simple electrical apparatus at home without needing special material.

Prospectus free from
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Master Minds of Modern Science

By T. C. BRIDGES & H. H. TILTMAN.
Tells of the achievements of Sir Oliver Lodge, Einstein, Marconi, Sir Frank Dyson, John L. Baird, etc.

Each Book Illustrated

7/6 net

(*Obtainable from all booksellers*)

HARRAP

Answers to Christmas Puzzles

The following are the solutions of the puzzles published on pages 932 and 933 of last month's "*M.M.*" These will enable readers to check the accuracy of their own attempts, and to see where they went wrong in any of the puzzles they were unable to solve.

No. 1. The numbers in the compartments on the left side of the triangle were, reading from top to bottom, 19, 17, 9, 15, 6 and 18, while those on the base line, reading from left to right, were 18, 16, 10, 13, 7 and 20. The numbers on the right-hand side, reading from top to bottom, were 19, 8, 12, 11, 14 and 20.

No. 2.

From SIX
take IX leaving S
From IX
take X leaving I
From XL
take L leaving X

SIX

No. 3. 1881 was the date on the foundation stone.

No. 4. The printers were sent Lewis Carroll's famous verse :—

The time has come the walrus said,
To talk of many things ;
Of shoes and ships and sealing wax,
And cabbages and kings.

No. 5. The palindromes were :—

No, it is opposed ; art sees trade's opposition.
Able was I ere I saw Elba.
Madam, I'm Adam.
Name no one man.

No. 6. The cat were separated by means of fences constructed as shown in Fig. 2.

No. 7. The numerals 1—9 were arranged as follows :—

$$2+6+4+5+8+\frac{79}{1}=100$$

$$94\ \frac{1578}{263}=100$$

$$96\ \frac{2148}{537}=100$$

$$91\ \frac{5823}{647}=100$$

No. 8. Hamper.

No. 9. £12-12-8 was the amount mentioned in the paper.

No. 10. In order to double the size of the pond, the man made a square with the four corners of the original pond as the middle points of the sides of the new one. In this way the actual area of the pond was doubled, while the trees were left untouched.

No. 11. A's apples each cost ½d., while the cost of each of B's was 1/3rd of a penny. Therefore the cost of two apples, one of A's and one of B's, would be 5/6th of a penny, the average cost of one being 5/12d. When selling at 5 for 2d. the cost of each one was 2/5d.—a loss of 1/60d. on each one, or a total loss of one penny on the entire number sold.

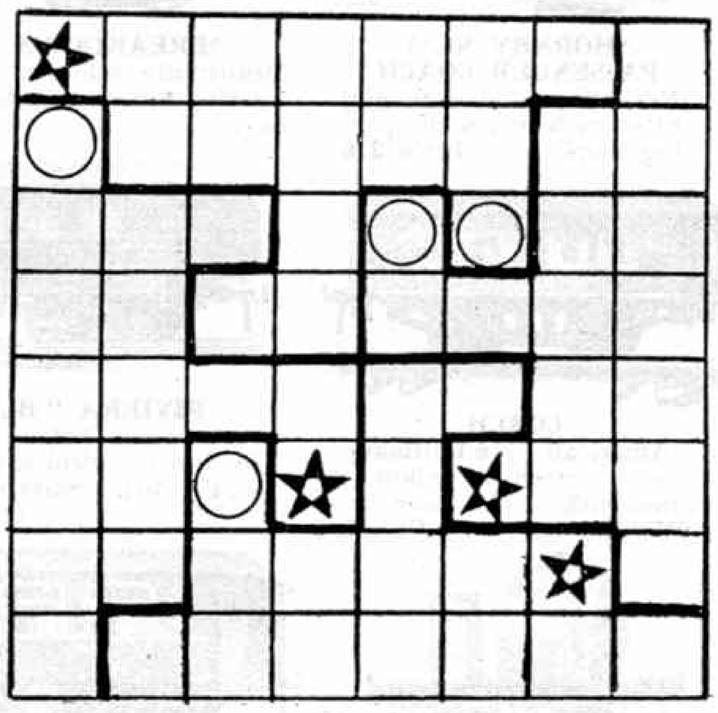


Fig. 1

No. 12. 103 miles is the shortest distance in which the railway official could make a tour of all the lines on the system. His route would be from G to D, D to A, A to C, C to A, A to B, B to D, D to C, C to F, F to D, D to F, F to G, G to B, B to E, and E to G.

No. 13. "Meccano" is the answer to this acrostic.

No. 14. The Hornby Train sets were the :—Continental Express, Riviera Blue, Cornish Riviera, Flying Scotsman, Royal Scot and the Metropolitan.

No. 15. The word actually was "Incomprehensible."

No. 16. Cannibals D and E made the first journey, and after leaving E on the island, D rowed back and took F across, bringing the boat back once again himself. A and B then went across, B bringing the boat back with E as passenger. He then went across again with D, and brought F back. B and C then went across together and left D to make two journeys for E and F.

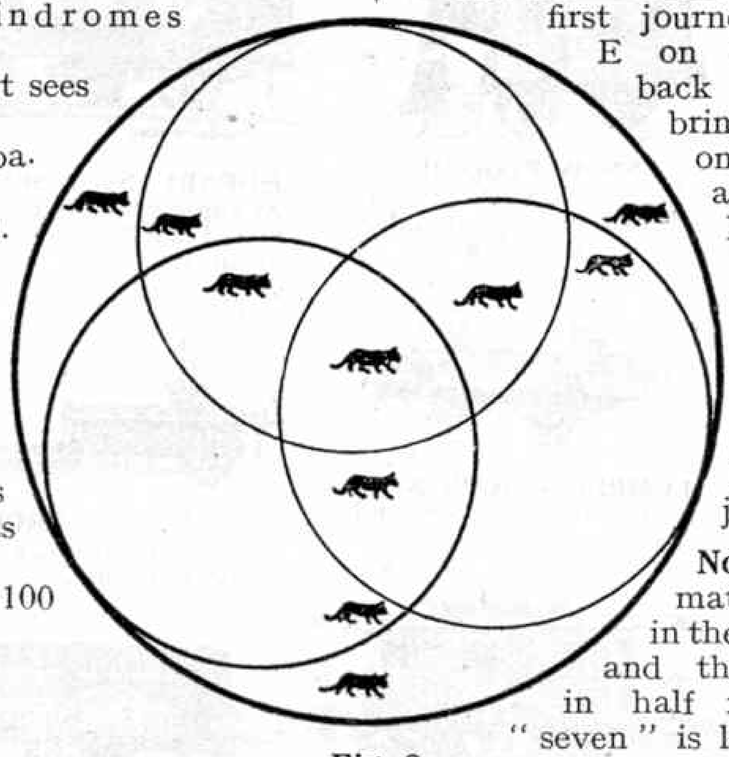


Fig. 2

No. 17. The eight matches should be arranged in the form of the Roman XII, and then by dividing them in half it will be seen that "seven" is left.

No. 18. The twelve hurdles were made into six triangular pens by arranging six of them in the form of a hexagon, the remainder being used to divide this up.

No. 19. The words hidden are :—skiff, mast, sloop, oar, tender and berth.

No. 20. The cat began to count from the sixth mouse.

No. 21. Jimmy composed the sentence "I owe you."

No. 22. The British prisoners were placed in cells Nos. 5, 7, 13 and 15 ; the Italians in 1, 4, 12 and 19 ; the Germans in 3, 10, 11 and 18, and the Russians in 6, 8, 14 and 16. (*Continued on page 96*)

HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines and are beautifully enamelled, mostly in the correct colours of the L.N.E., L.M.S., G.W. or Southern Railways.

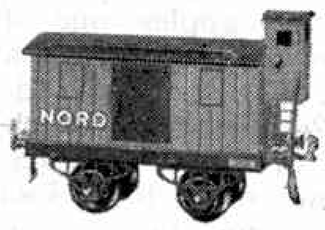
Ask your dealer to show you the full range of Hornby Rolling Stock.

PETROL TANK WAGON "PRATTS"
Finished in green.
Price **2/6**

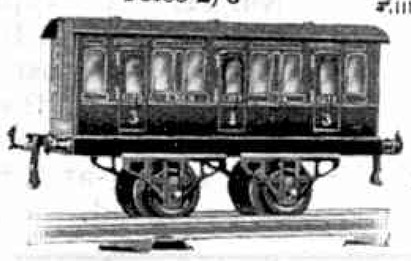
PETROL TANK WAGON "B.P."
Finished in yellow.
Price **2/6**

PETROL TANK WAGON "SHELL"
Finished in red.
Price **2/6**

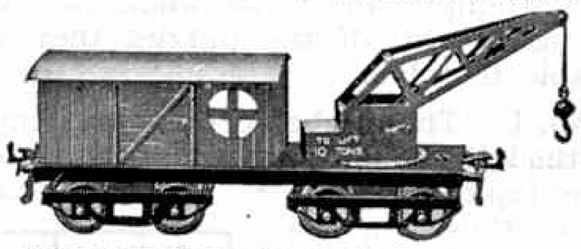
OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/6**



BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**

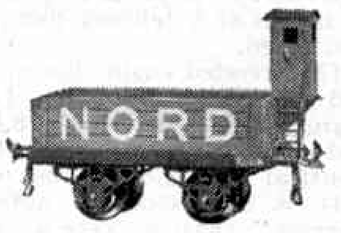


***HORNBY No. 1 PASSENGER COACH**
Realistic in design and fitted each side with opening doors. Price **2/6**

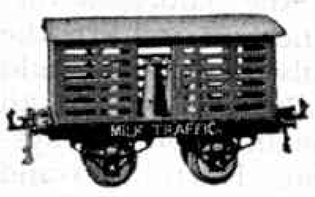


***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**

GUARD'S VAN
Realistic design, fitted each side with opening doors. Obtainable in L.N.E.R., L.M.S., G.W. or S.R. colours. Price **3/-**

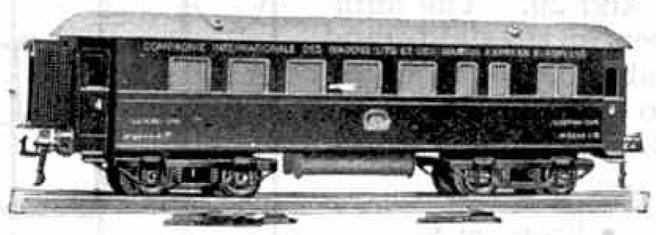


WAGON (French Type)
Lettered "Nord." Highly finished in colours. Price **3/3**

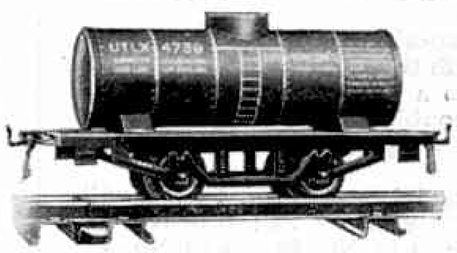


MILK TRAFFIC VAN
Fitted with sliding doors. Complete with milk cans. Price **3/6**

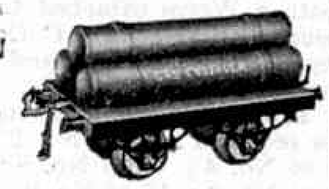
COACH (American Type Pullman)
Coloured green or yellow and named either "Madison" or "Washington." Price **1/6**



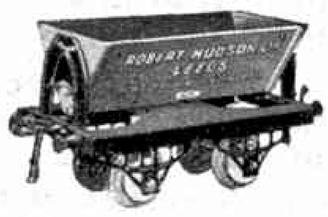
RIVIERA "BLUE" TRAIN COACH
"Dining" or "Sleeping."
This is a beautiful model, substantially built and well finished. Suitable for 2-ft. radius rails only. Price **14/-**



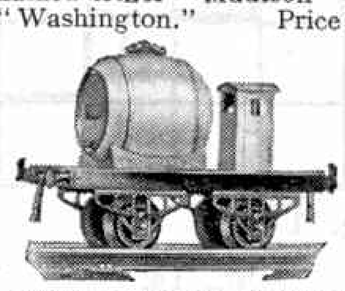
TANK CAR (American Type)
Model of the type of tank car used in America for the conveyance of oil, etc. Price **1/9**



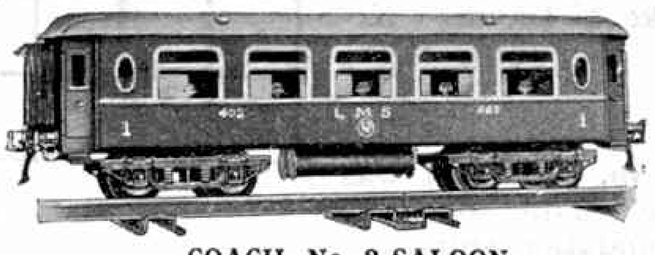
GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**



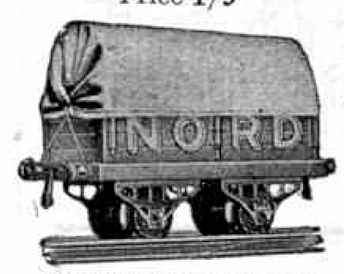
SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**



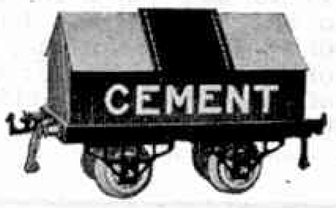
WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/-**



COACH, No. 2 SALOON
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**

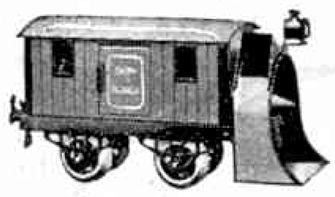


COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type, lettered "Nord." Price **3/-**

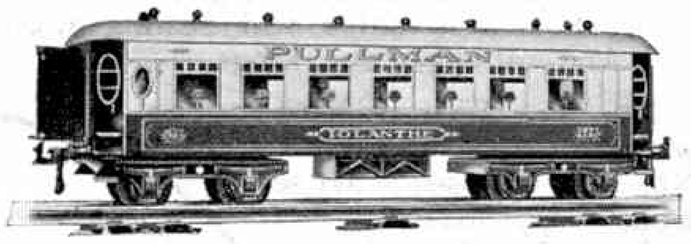


CEMENT WAGON
Finished in red. Price **3/-**

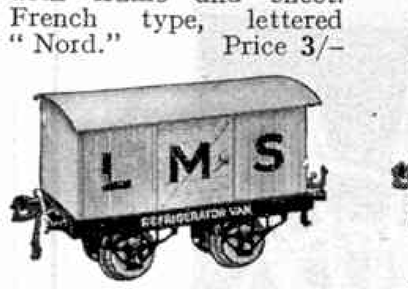
TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**



SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**

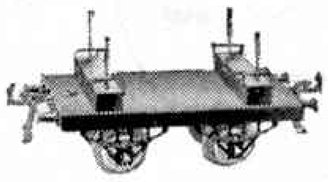


HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/-**

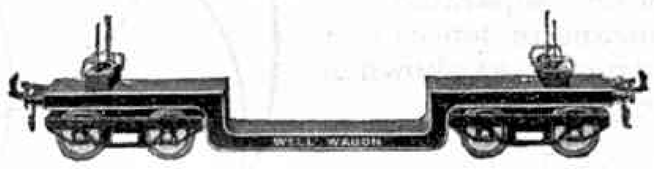


***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/9**

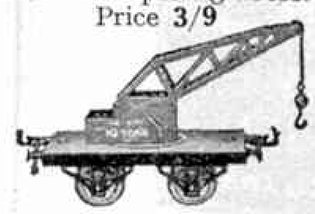
***LUGGAGE VAN No. 1**
With opening doors. Price **3/6**



LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/-**

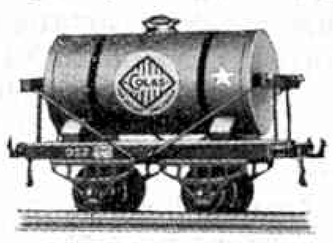


TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

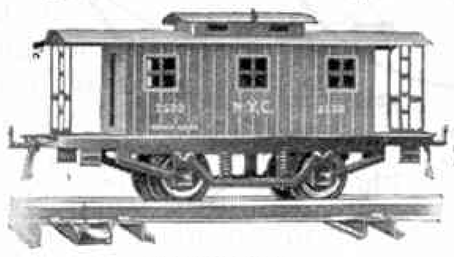


CRANE TRUCK
Finished in brown and blue. Price **3/6**

***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**

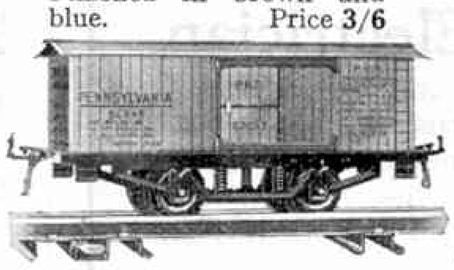


BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**



CABOOSE
Modelled on the type of brake van used on American railroads. Price **2/6**

TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**

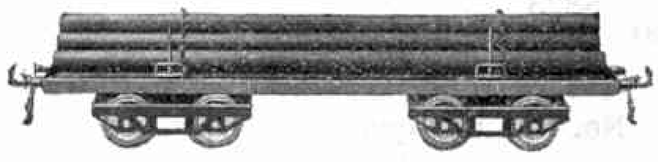


BOX CAR
This is a model of the type in use on American railways. Price **2/6**

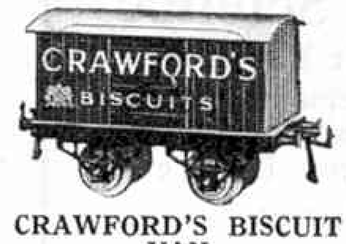
MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/-**

JACOB'S BISCUIT VAN
Finished in crimson lake. With opening doors. Price **3/6**

CARR'S BISCUIT VAN
Finished in blue. With opening doors. Price **3/6**



LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **4/-**



CRAWFORD'S BISCUIT VAN
Finished in red. Opening doors. Price **3/6**

SECCOTINE VAN
Beautifully finished in blue. With opening doors. Price **3/6**

In L.M.S., L.N.E.R., G.W., or S.R. lettering.

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL

HORNBY SERIES

HORNBY ACCESSORIES

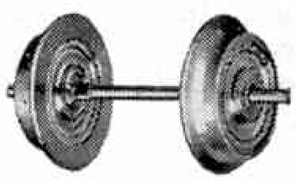
HORNBY SERIES

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.

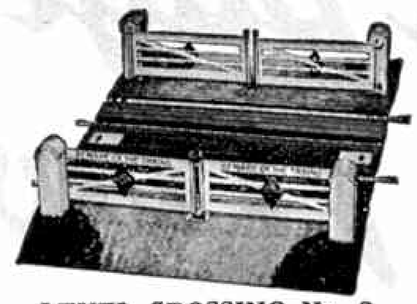
DOUBLE ARM SIGNALS No. 1
Price 4/3 per pair.
DOUBLE ARM SIGNAL No. 2
(As illustrated.)
Price 3/– each.

OIL CAN No. 2 ("K" Type)
This miniature Oil Can operates perfectly. The oil is ejected drop by drop by depressing the valve. Polished Copper. Price **3/6**



MANSELL WHEELS
These solid die-cast wheels are correctly designed and may be fitted to Hornby Wagons, Vans, Coaches, etc. Price, per pair, **4d.**

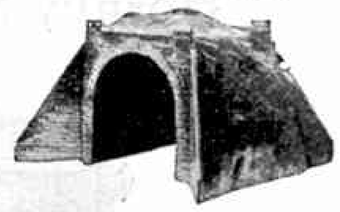
M STATION SET, 7 pieces
Price complete, **3/6**
The components of the M Station Set may be purchased separately as follows:—M Wayside Station. Price, each, **1/–**
M Signal Box ... Price, each, **6d.** M Signals ... Price, each, **4d.**
M Station ... Price, each, **1/3** M Telegraph Poles. Price, each, **4d.**



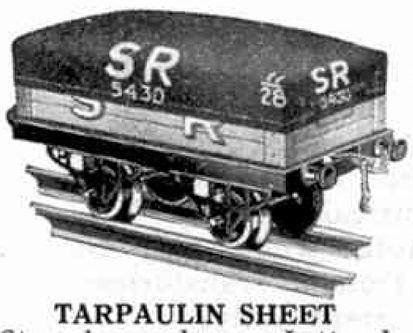
LEVEL CROSSING No. 2
Measures 13⅓ × 10¼ ins., with two tracks of gauge 0 rails in position ... ... Price **5/6**

LEVEL CROSSING No. 2 (Electrical)
Similar to Level Crossing No. 2, but fitted with two electrical tracks ... ... Price **8/–**

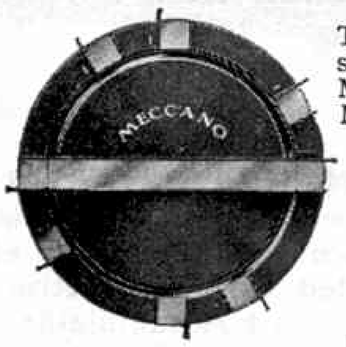
SIGNAL No. 2
Price **2/6** each.
"Home" or "Distant."



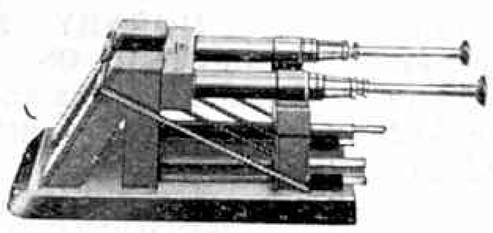
TUNNEL
Realistic and finished in colours ... Price **7/6**



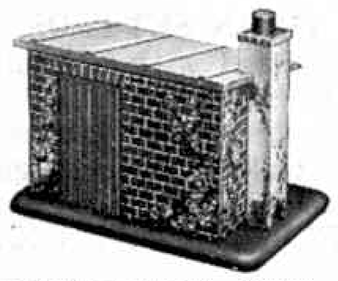
TARPAULIN SHEET
Strongly made. Lettered L.M.S., G.W., N.E. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon. Price **3d.**



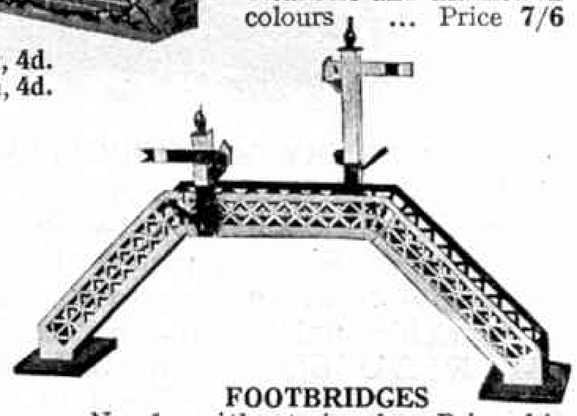
TURNTABLE No. 2
Price **4/6**
TURNTABLE No. 2 (Electrical)
Similar to Turntable No. 2, but fitted with electrical rails ... Price **8/6**



BUFFER STOPS No. (HYDRAULIC)
Price **5/6**



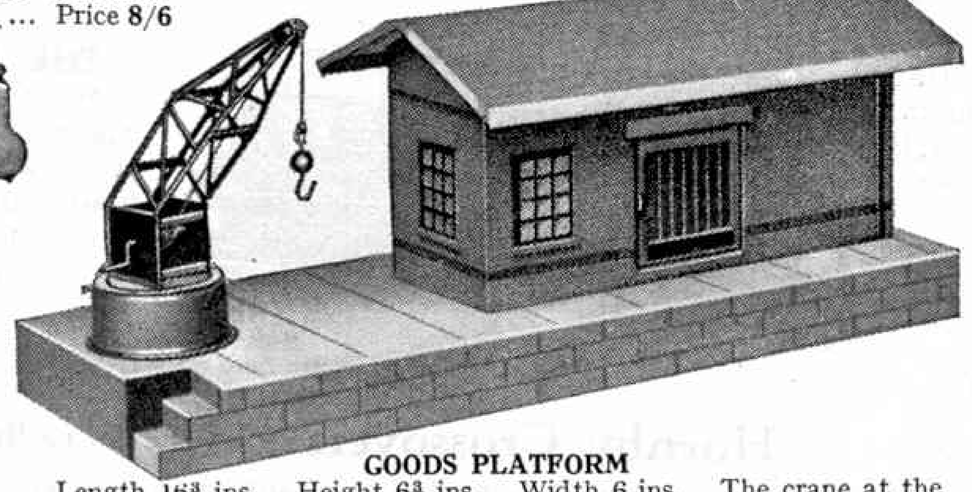
PLATELAYER'S HUT
Price ... **2/6**



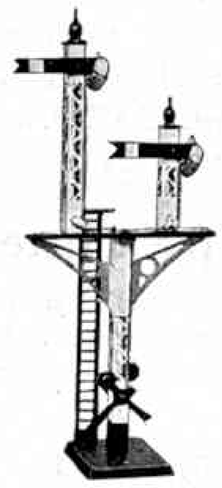
FOOTBRIDGES
No. 1, without signals. Price **4/–**
No. 1a, with detachable tin-printed signal posts and arms ... Price **4/9**
No. 2, with detachable enamelled signal posts and arms (as illustrated). Price **7/6**
Signals only, for No. 2 footbridge. Price ... ... per pair **3/9**

SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price **2/9**

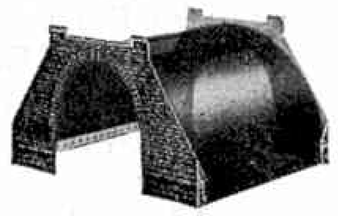
LAMP STANDARD No. 1 (SINGLE)
An electric flash-lamp bulb may be fitted into the globe. Price **3/6**



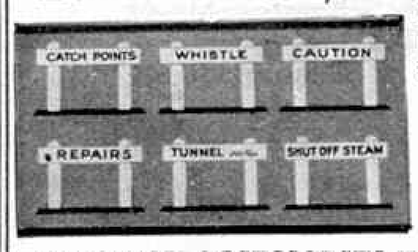
GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price **12/6**



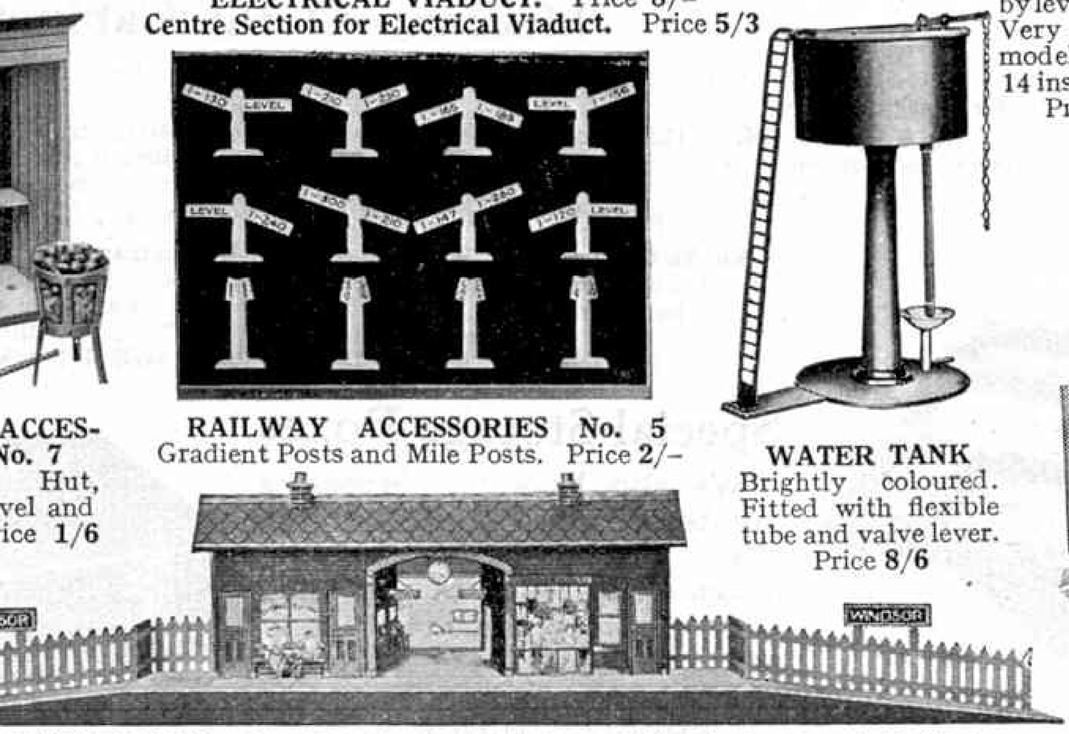
JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. Very realistic model, standing 14 ins. in height. Price **6/–**



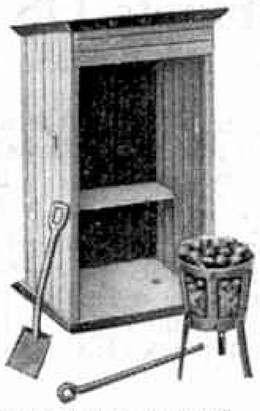
TUNNEL ENDS
These Tunnel Ends add realism to Tunnels made of cardboard, or other suitable material. They may be fitted into position quite easily.
Price, per pair, **2/9**



RAILWAY ACCESSORIES No. 8
Notice Boards.
Price, per set, **2/3**



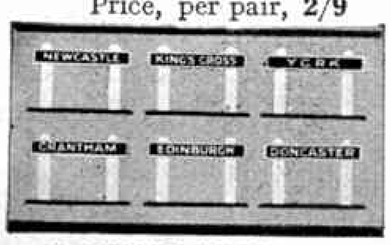
VIADUCT. Price **7/–**. **Centre Section only.** Price **4/9**
ELECTRICAL VIADUCT. Price **8/–**
Centre Section for Electrical Viaduct. Price **5/3**



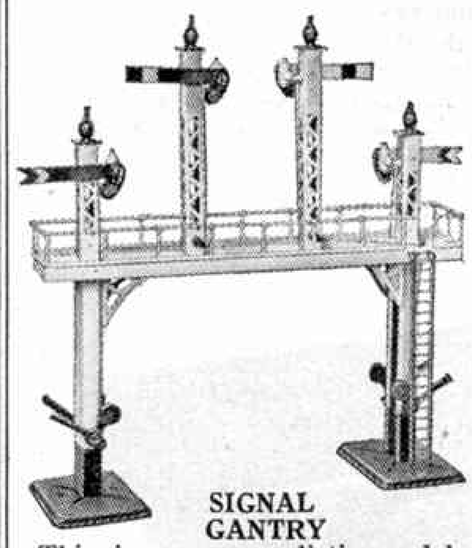
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price **1/6**

RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts. Price **2/–**

WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever.
Price **8/6**

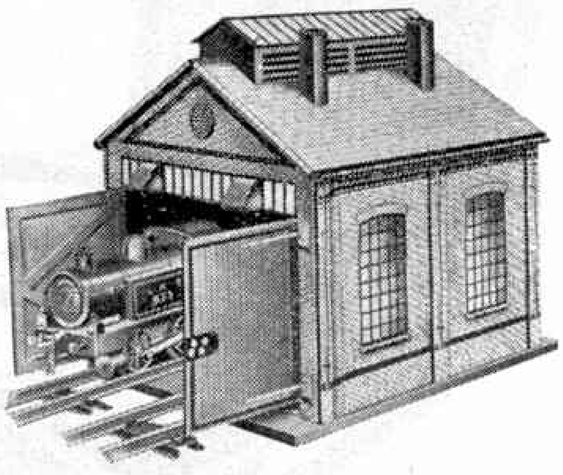


RAILWAY ACCESSORIES No. 9
Station Name Boards.
Price, per set, **2/6**



SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/–**

RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable. Dimensions: Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price **12/6**



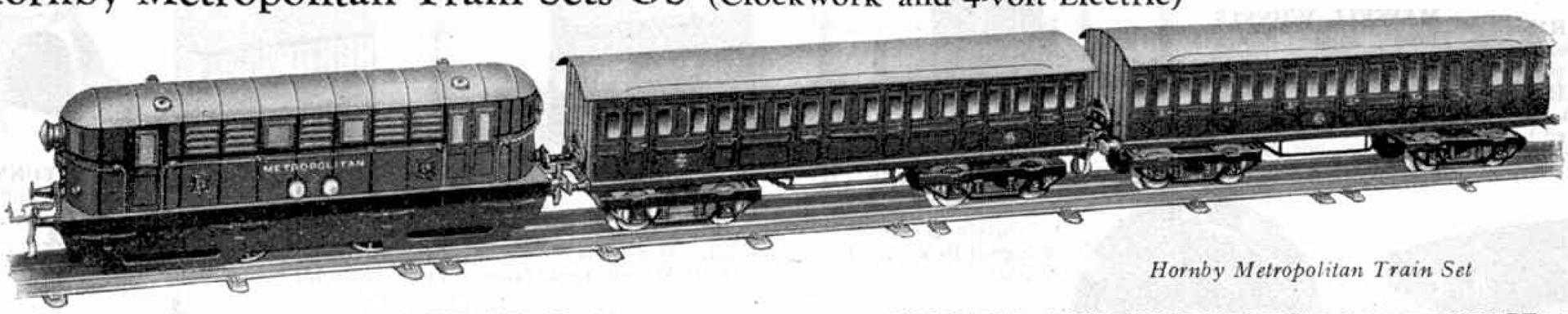
ENGINE SHED No. 1
This Shed is beautifully finished in realistic colours. It will accommodate Locomotives and Tenders of the M series, and Locomotives of No. 0 and No. 1 types ... ... Price **15/–**

A page of New Year Bargains

Are you a bargain-hunter? Whether you are or not we are sure you will find something to interest you on this page. Come on boys, do not miss this splendid opportunity—every item featured is a genuine bargain!

These goods are being offered at the greatly reduced prices indicated, because they are of 1928/9 design and are not now listed in our catalogues. They are of the finest quality and will give every satisfaction.

Hornby Metropolitan Train Sets OS (Clockwork and 4-volt Electric)



Hornby Metropolitan Train Set

HORNBY METROPOLITAN TRAIN SET C. OS contains a powerful clockwork locomotive, fitted with reversing gear and brake mechanism, two coaches and set of rails, including a Control Rail, by means of which the trains may be braked or reversed from the track. The train is well designed and is richly finished in correct colours.

REDUCED PRICE **32**/– POSTAGE 1/3 EXTRA.
Previous price 55/–.

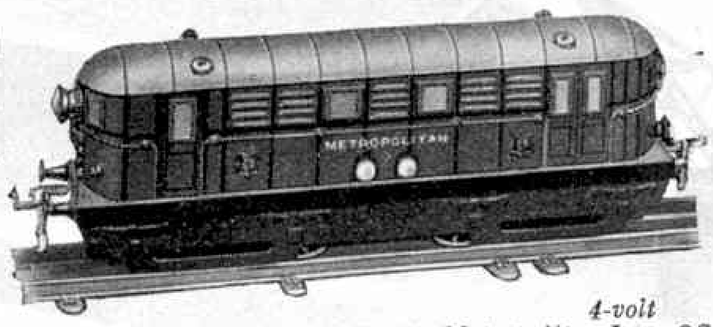
HORNBY METROPOLITAN TRAIN SET 4-VOLT ELECTRIC OS contains a 4-volt electric locomotive, two coaches, resistance controller and electrical rails. The locomotive is fitted with an electric motor which may be operated from a 4-volt Accumulator or from a Transformer connected to the main (alternating current only).

REDUCED PRICE **60**/–. POSTAGE 1/3 EXTRA.
Previous price 95/–.

Hornby Metropolitan Locomotives OS (Clockwork and 4-volt Electric)

THE CLOCKWORK MODEL OS is fitted with reversing gear and brake mechanism, which may be controlled from the cab or, if a Control Rail is employed, from the track.

REDUCED PRICE **14**/–.
POSTAGE 9d. EXTRA.
Previous price 22/6.



4-volt Metropolitan Loco OS

THE ELECTRIC MODEL OS is fitted with a 4-volt electric motor which is operated from a 4-volt Accumulator or from a Transformer connected to the main (alternating current only).

REDUCED PRICE **30**/–.
POSTAGE 9d. EXTRA.
Previous price 47/6.

Hornby Wire Cutters

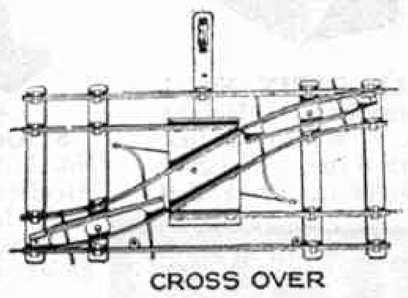
This is an extremely useful tool, especially for boys who are interested in the construction of electrical models or wireless sets.

REDUCED PRICE **1**/–.
POSTAGE 2½d. EXTRA.
Previous price 1/6.

Hornby Crossovers OS (2 ft. radius)

Here is a bargain line that will appeal to all boys who possess a Hornby Railway. The Crossovers may be used in all double tracks that are constructed from single Hornby Rails, but will not fit the latest Hornby Double Track Rails.

REDUCED PRICE **3/3**. POSTAGE 6d. EXTRA.
Previous price 6/– each.



CROSS OVER

No. 5a Oak Cabinet OS.

Meccano Outfit Cabinets OS

These Cabinets are not quite suitable for the latest contents of the respective Outfits and are therefore being disposed of at bargain prices.

No. 5 Cabinet OS. This strongly-built oak cabinet is exquisitely finished. It is made in two sections, upper and lower, each of which is fitted with wooden partitions. The cabinet is provided with lock and key.

Dimensions: Length 17½". Width 12½". Depth 3¼".
REDUCED PRICE **25**/–. POSTAGE 1/3 EXTRA. Previous price 35/–.

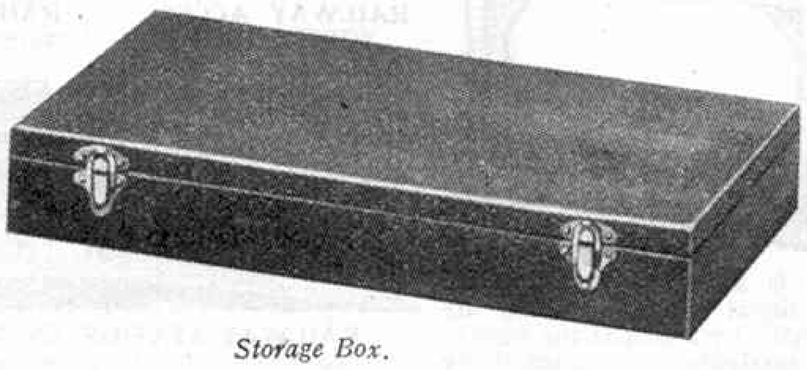
No. 5a Cabinet OS. No. 5a Cabinet OS (illustrated) is available either enamelled a very attractive shade of blue, or in stained and varnished oak. There are two sections, upper and lower, each of which is partitioned. The lid is hinged and is secured by means of lock and key.

Dimensions: Length 12". Width 15½". Depth 3".
REDUCED PRICE **20**/–. POSTAGE 1/3 EXTRA. Previous price 35/–.

Special Storage Boxes

We also have for disposal a number of useful wooden storage boxes. These boxes are strongly made, enamelled both inside and outside in an attractive shade of green, and are fitted with two strong spring clasps.

SPECIAL PRICE **2**/-.
POSTAGE 9d. EXTRA.



Storage Box.

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HOBBIES FAMOUS FRET OUTFITS

1/-, 2/6, 4/6, 6/-, 10/6 to **25/-**

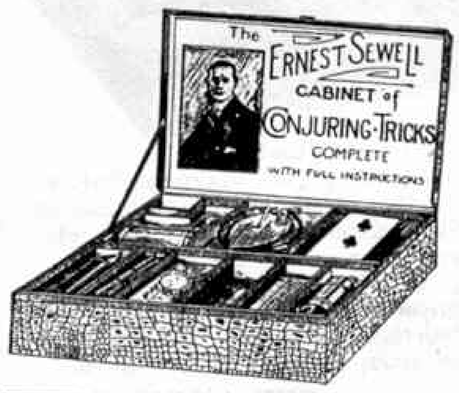
Wonderful value.

FRET MACHINES

35/-, 50/-, 75/-

Free Delivery 5 miles.

Free on rail.



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6 Tricks ... **2/-**
10 Tricks ... **3/6**
17 Tricks ... **7/6**

Free Price List.

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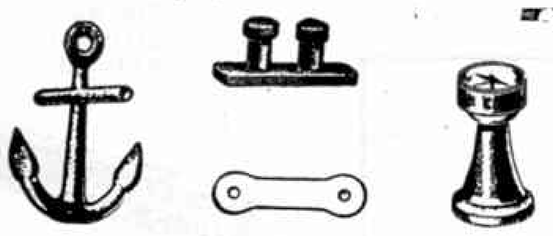
Plain Blocks ... ... from each **1½d.**
Brass Screw Eyes, all sizes ... per doz. **3d.**



Anchors... ... ... each **3d.** & **6d.**
Bollards, solid brass ... ... **6d.**
Bowsies ... ... per doz. **6d.**
Mariners' Compass ... ... **9d.**

Full Price List Post Free.

MOTOR LAUNCH & SAILING YACHTS.

MOTOR BOATS

Steam ... ... **14/6** to **£7/7/-**
Electric ... ... **21/-** to **£3/10/-**
Clockwork ... ... **5/6** to **£3/3/-**

SAILING YACHTS 3/6 to **£4/10/-**

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Small, with Pocket Lamp Battery. Price **4/3.**

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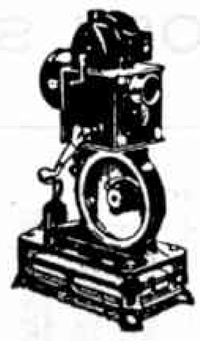

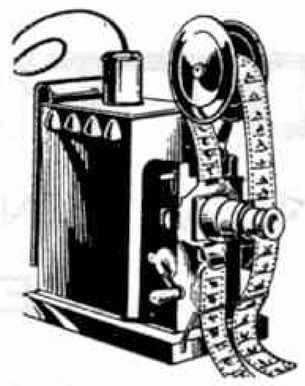

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Pathé Kid **£2/15/-**

Special Films for these **2/6, 3/6, 6/-**

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We hold a large stock of refills and apparatus.

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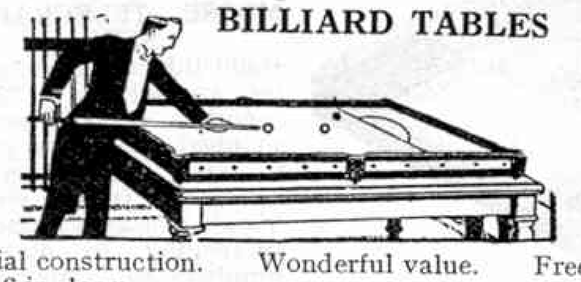

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3 ft. 6 in. long	...	**35/-**
4 ft. „	...	**45/-**
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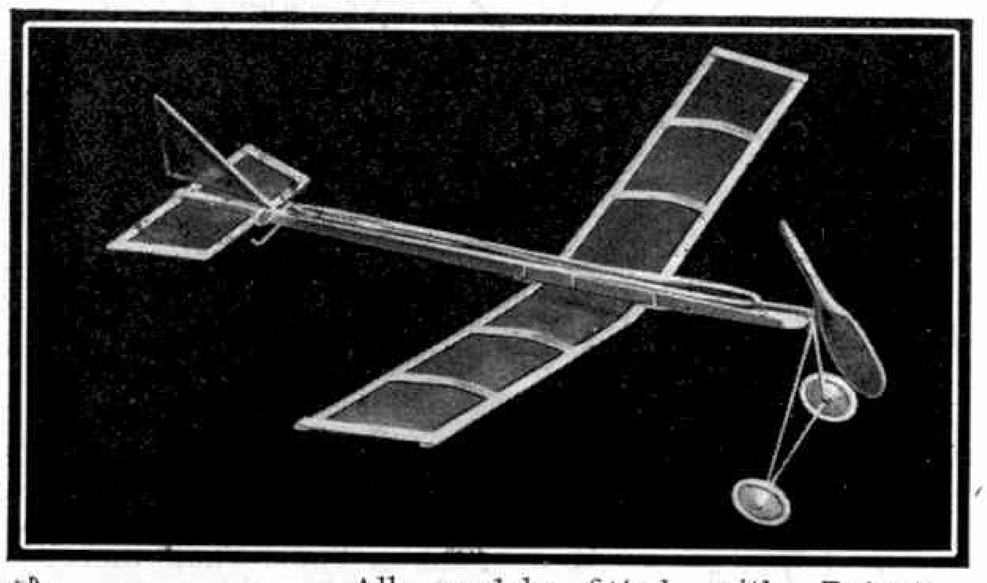
We also stock STEAM ENGINES and MODELS, ROLLER SKATES, CYCLES, POCKET LAMPS, AEROPLANES, KITES, WIRELESS, etc.

THE NEW "SKISAIL" TRACTOR
MODEL AEROPLANES

Constructed of highest quality materials. Patent No. 23533. **Perfect flight guaranteed.** Patent No. 138210.



All models fitted with **Patent Adjustable Rudder** which controls flight of aeroplane in any direction, and **New Lightweight Shockproof Chassis.**

Wing Span of 18/6 Model 33 in. Fitted with Patent Safety Chassis with Landing Skids. Wingspan of our 4/6 model 21 in.

No. 0	Price	**18/6**
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„ 3	„	**8/6**
„ 4	„	**6/6**
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The "Skisail Model de Luxe"
Wing Span 42 in. Price 27/6

The "Skisail" Monoplane Constructional Set **10/6**

"SKISAIL" MONOPLANES are obtainable from the leading Stores, Toy and Sports Dealers, including

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Start 1931 resolved to get fit and to stay fit. Buy a "Terry" now. Your sports dealer will be glad to show you the range of "Terry" Exercisers. Accept no substitute.

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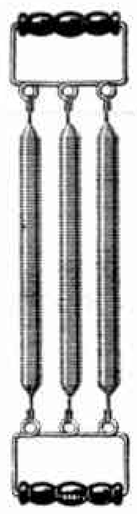
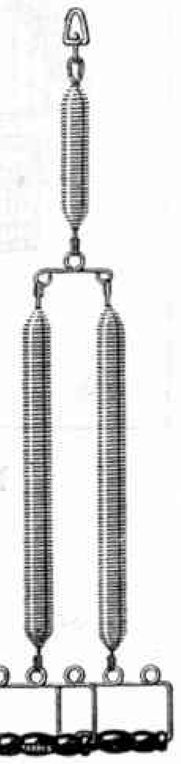


3-strand Chest Expander.



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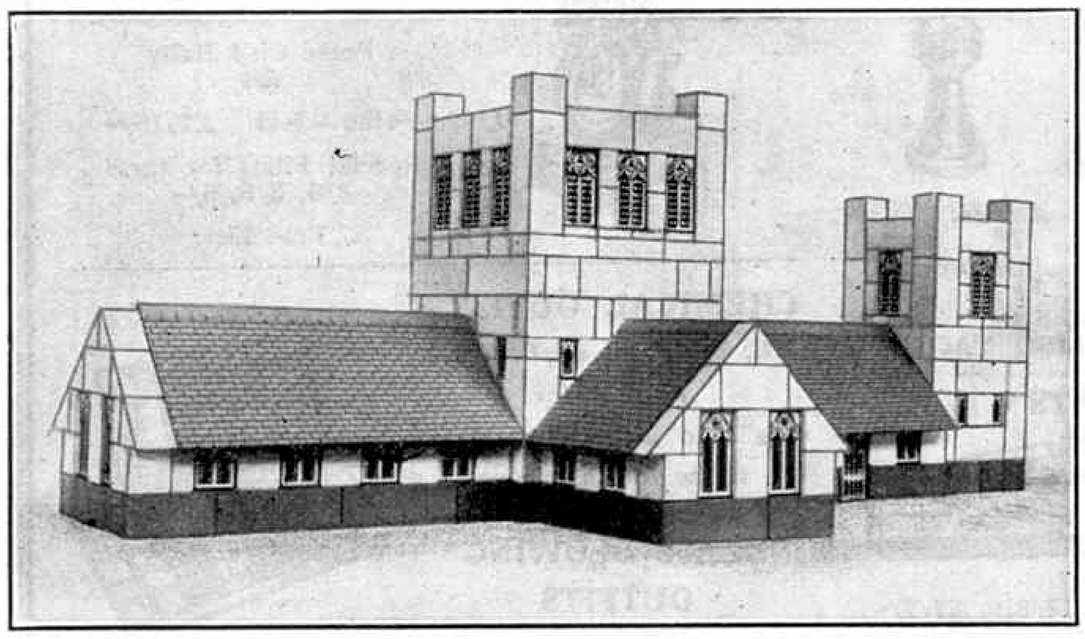
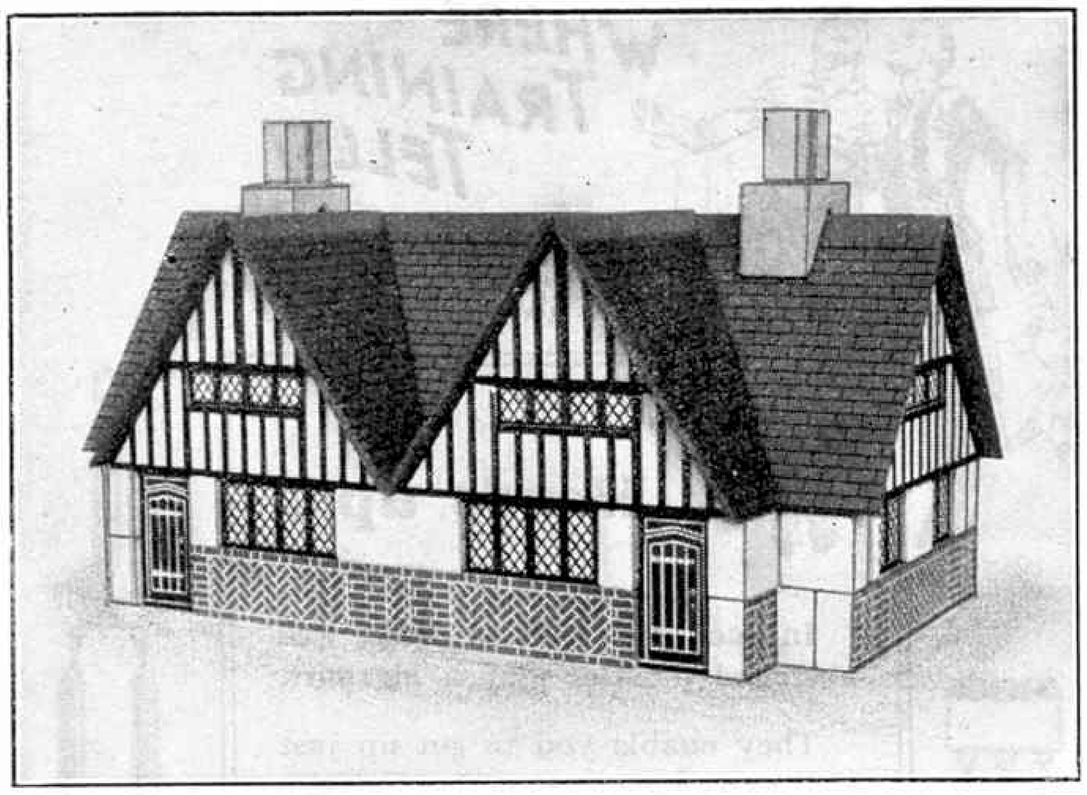
NEW WINDOW AND DOOR ACCESSORY SETS



Cathedral built with Lott's Bricks

EVERYONE who already possesses a box of Lott's Bricks or Tudor Blocks will appreciate one of these new Accessory Sets. They consist of collections of stone bricks, embossed and coloured on one side to represent various windows and doors and Herringbone Bond base bricks. It will be seen from the illustrations that with the aid of these new bricks, Lott's Bricks models can now be made more perfectly realistic than ever before.



Pair of Houses built with Tudor Blocks

PRICES

Accessory sets, containing designs for use with Lott's Bricks.

Box 1.	For Boxes 2–3	... ...	5/–
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Accessory sets, containing designs for use with Tudor Blocks.

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Write to-day for illustrated lists

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THE "REGENT" ELECTRICAL SET.
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Shows how electricity is generated :- how to make an electrical shocking coil, magnets, batteries, electric bells; explains the wonders of the telegraph, telephone, microphone, etc. Every experiment is perfectly harmless.

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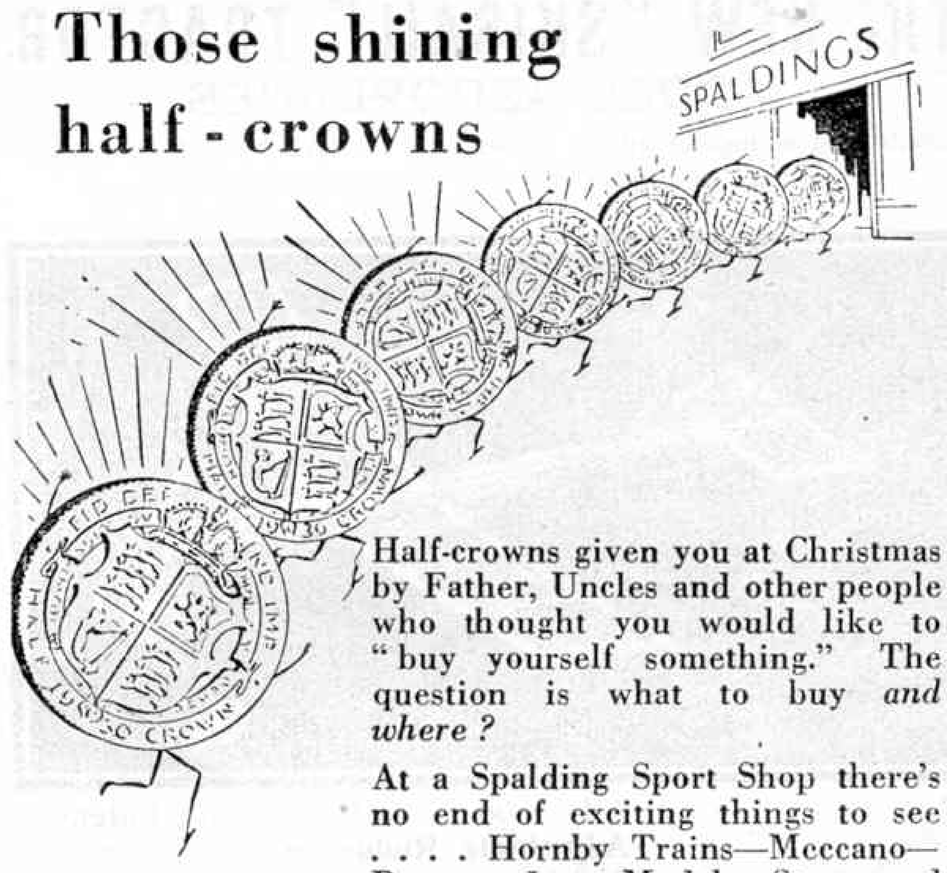

Half-crowns given you at Christmas by Father, Uncles and other people who thought you would like to "buy yourself something." The question is what to buy *and where ?*

At a Spalding Sport Shop there's no end of exciting things to see . . . . Hornby Trains—Meccano—Bowman Loco Models—Steam and Electric Boats—Model Yachts and Aeroplanes. Come along and see them before all that money burns a hole in your pocket ! And bring Father too—he'll enjoy himself as much as you will.

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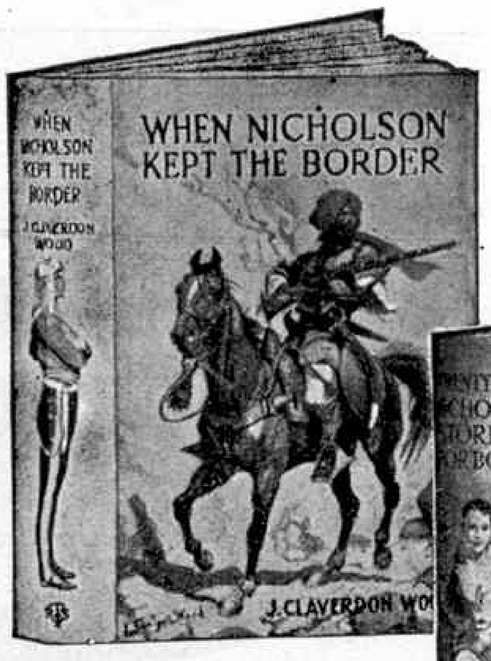

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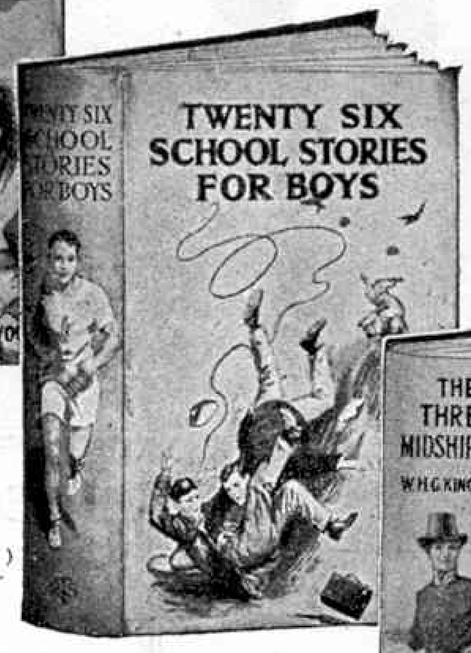

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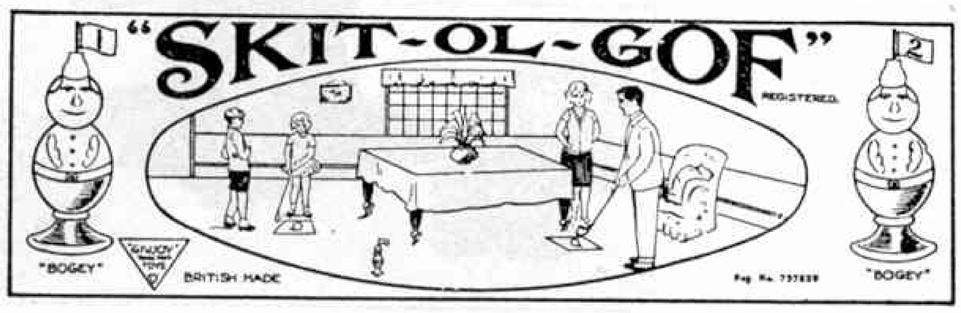

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9 Rubber Tee Mats (Numbered).
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Score Cards for 18 Rounds and Instructions.

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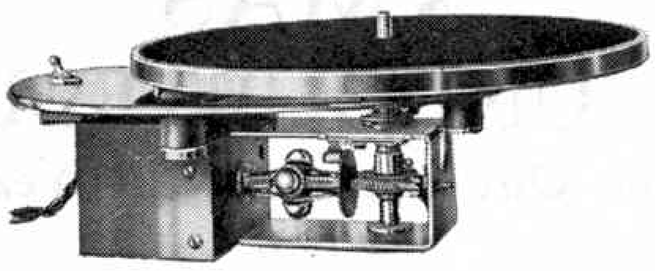

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for driving small lathes, drilling machines, etc. Available in 1/8, 1/6, 1/4, 1/3, 1/2 and 3/4 H.P. ratings for A.C. or D.C. supply.

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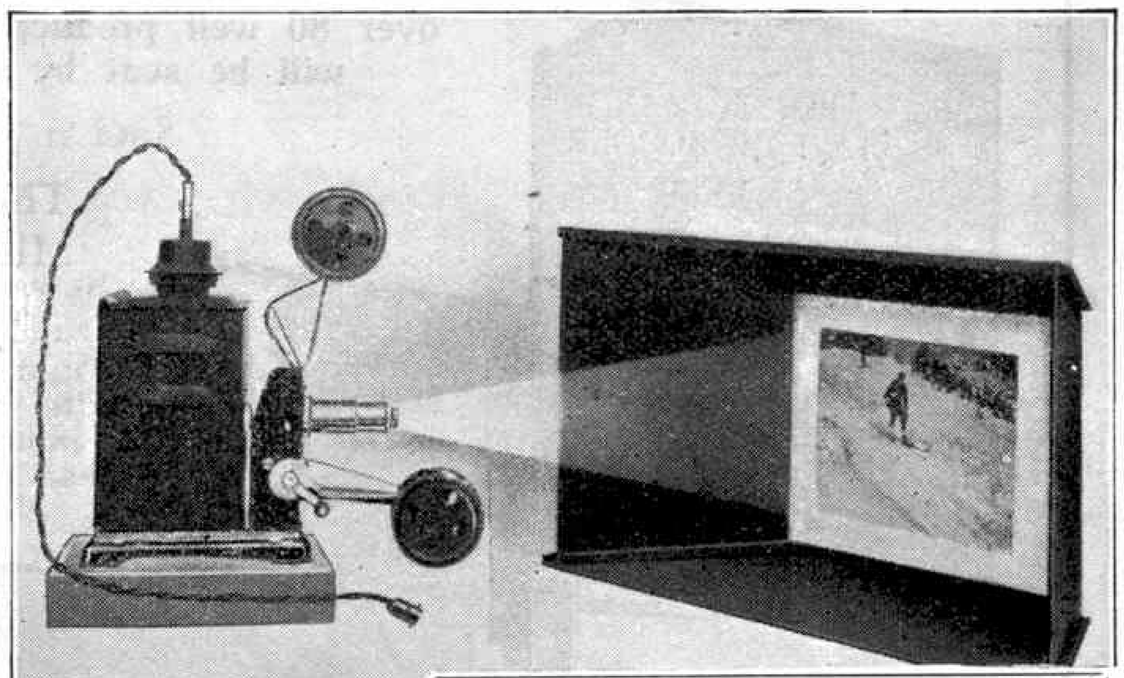

Box Screen as illustrated 5/- extra
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Price 18/6

A REAL CINEMA AT THE PRICE OF A TOY
Complete with Pocket Battery, Spot-light, Lamp, Superior Lenses, Re-winder, Split-Spools, and four different 18 ft. specially selected Films (in tin box).
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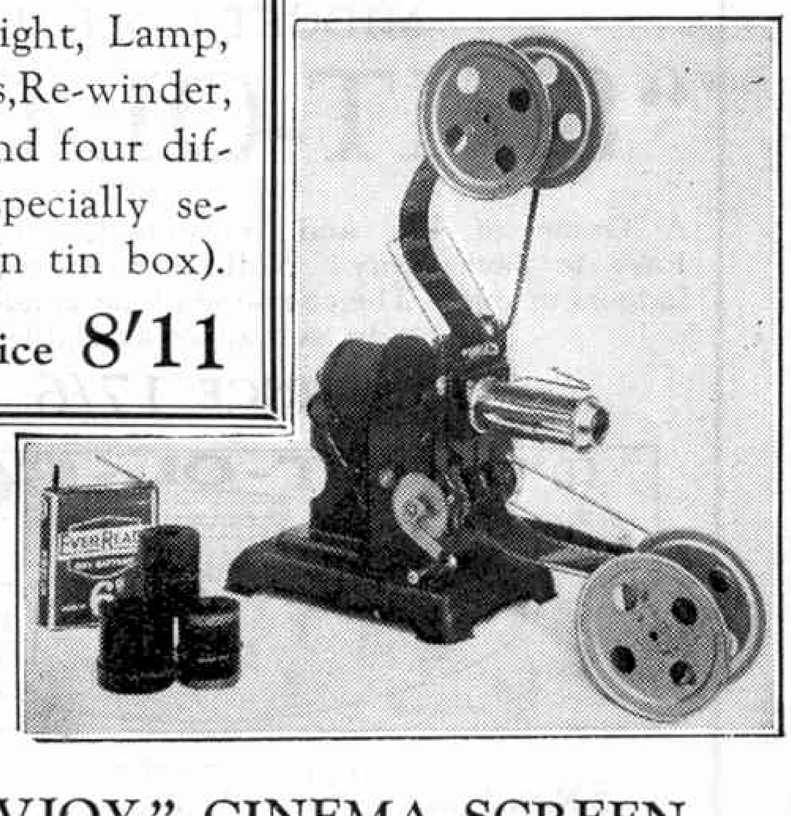

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The "**GIVJOY**" Folding "**CINEMA SCREEN**" will simplify and complete your **CINEMA SHOW**—when set out, its side wings and top flap exclude the light and the pictures come out clear and distinct. Size of screen 14" × 10¾". Window extension when open, 24" × 13". Each Screen boxed. Price 5/-

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36 ft.	...	...	...	...	" **1/-**	"	**4/-**	"	"
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144 ft.	...	...	...	...	" **2/6**	"	**10/-**	"	"

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Super All-Steel Automatic Self-Inking

PRINTING MACHINE!

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There's not a more exciting or interesting hobby than printing on my Wonderful Invention. You can print your own Note-headings and Visiting Cards—Entertainment Programmes—Party Invitation Cards—School Magazines and a 101 other interesting things. It's so fascinating that you'll want to spend every spare moment at it!

The Marvellous "Adana" All-Steel Super 1930 Model Automatic Self-inking Printing Machine .... Specially designed for Commercial Use in All Large and Small Printing Establishments.

Price

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- Noteheadings
- Visiting Cards
- Menus
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Let me tell you all about my Wonderful Machine and what it will do. Send the coupon alongside TO-DAY and I will send you ABSOLUTELY FREE actual samples of work produced and explain how I will let you have it on Special Terms.

No boy should miss this Splendid Bargain. It is a Real Commercial Machine, for many men make Spare Time Money by printing on it for Local Tradesmen, etc. Find out all about it NOW. Send the Coupon alongside at once to

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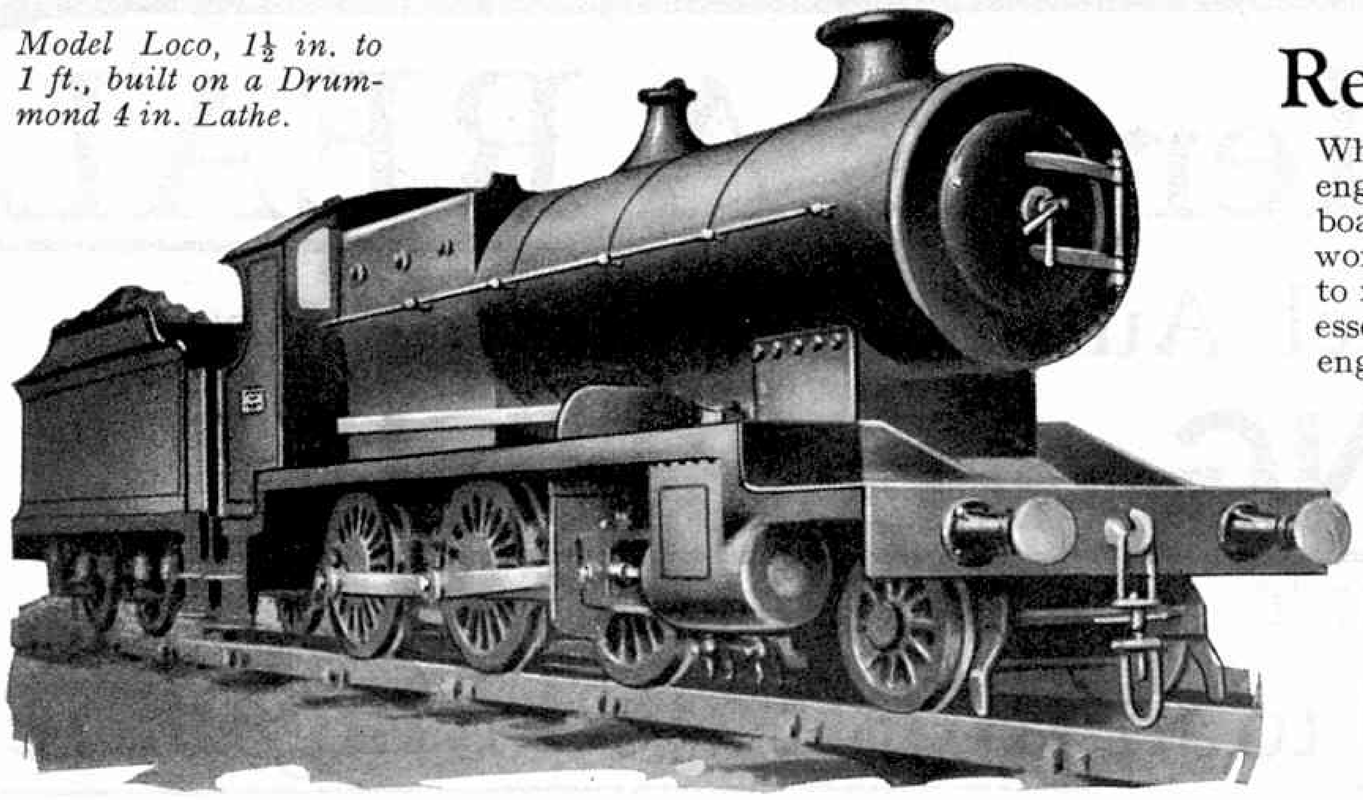

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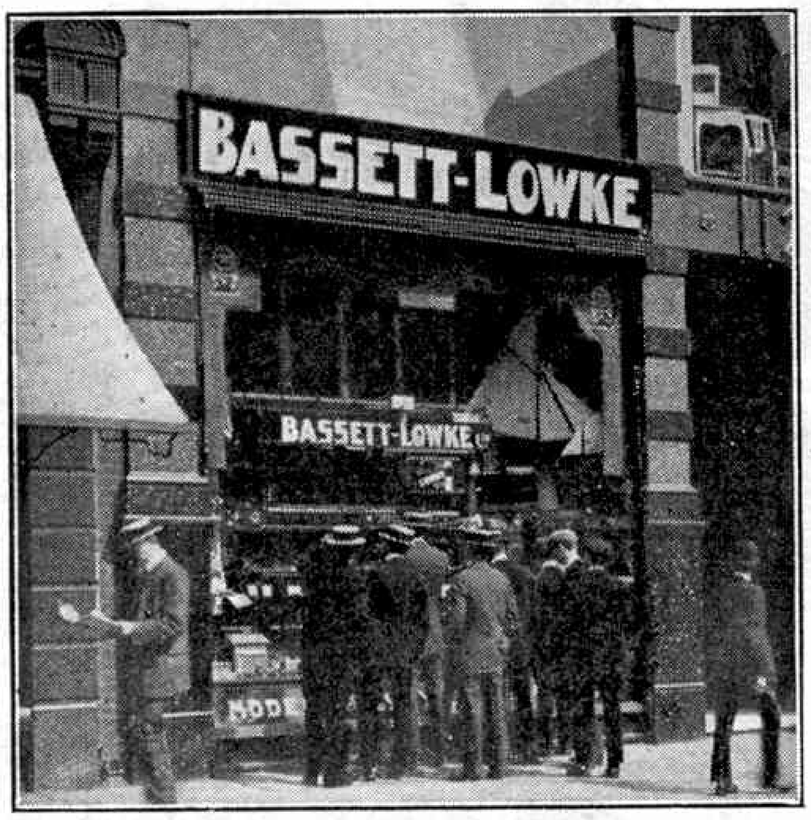

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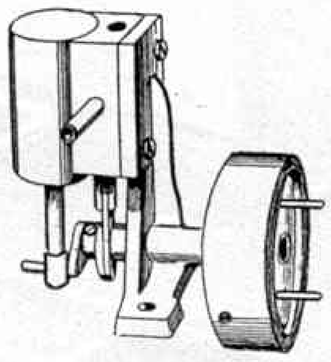

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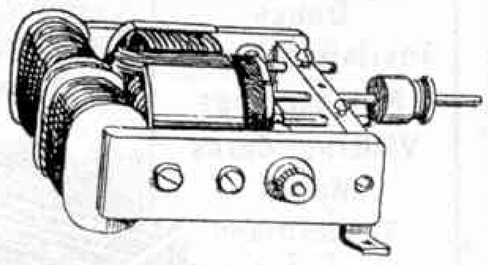

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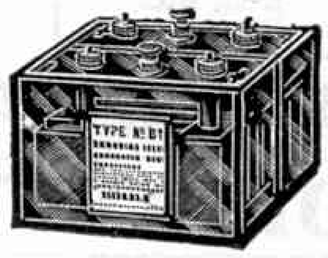

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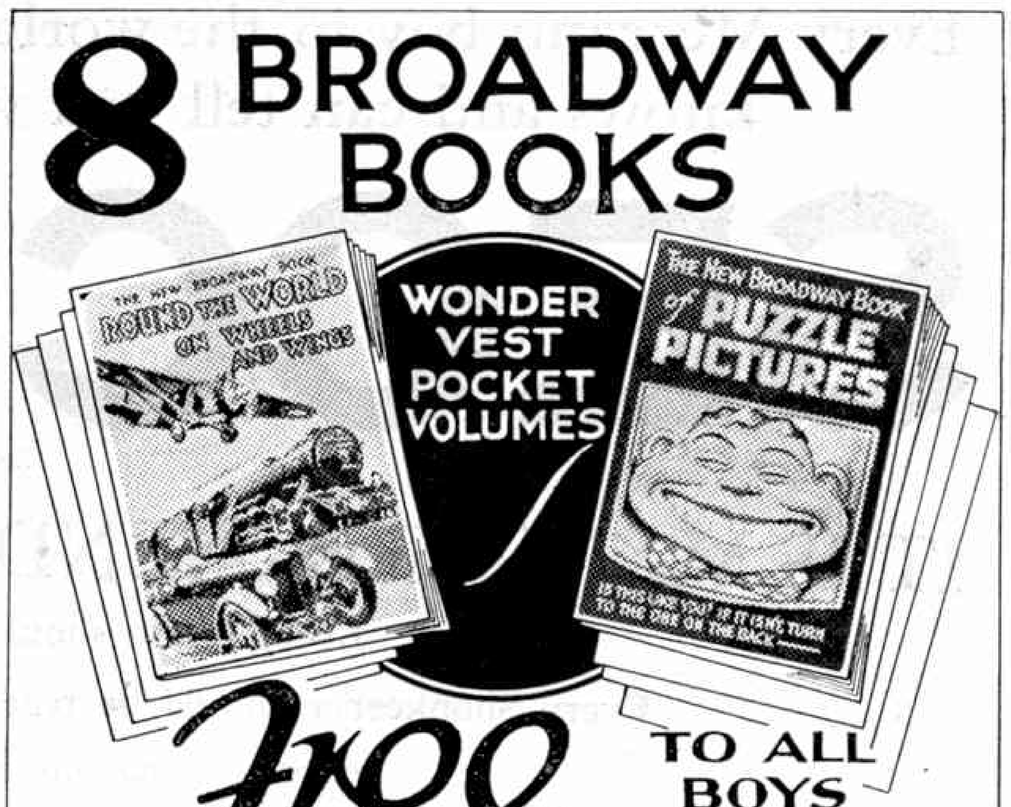

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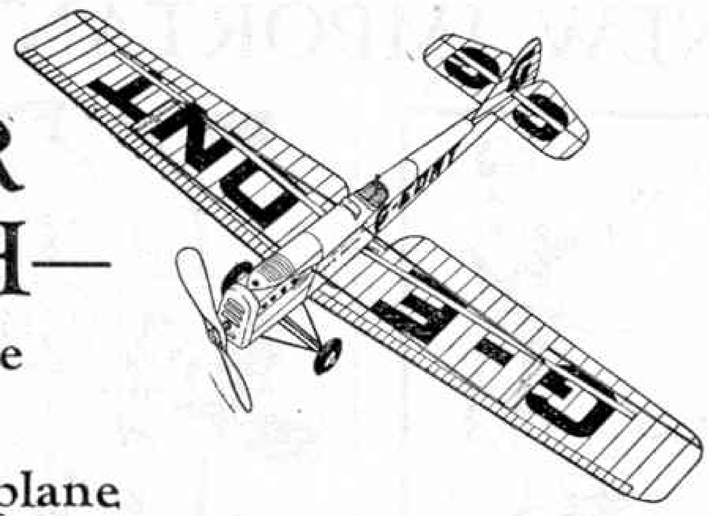

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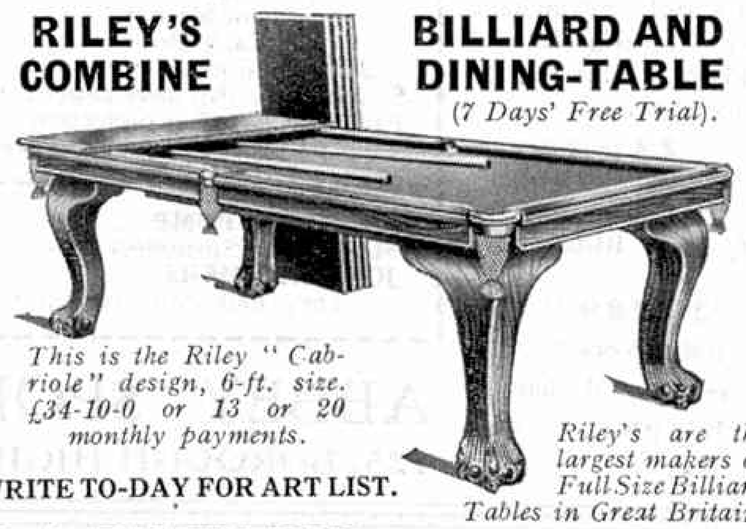

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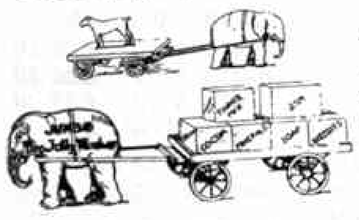

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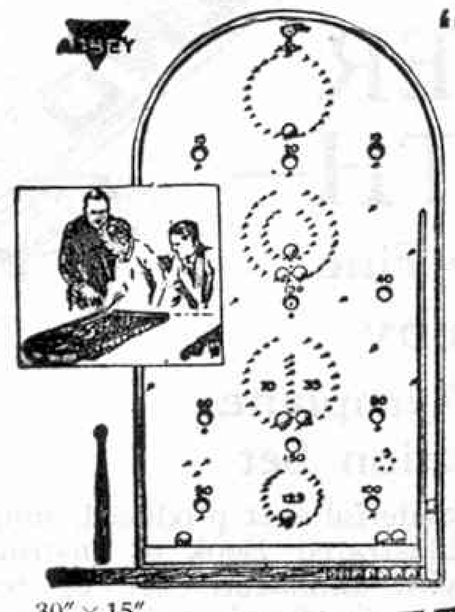

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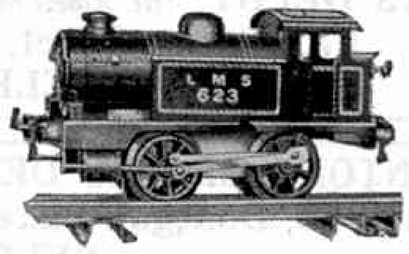
HORNBY TANK LOCOMOTIVES



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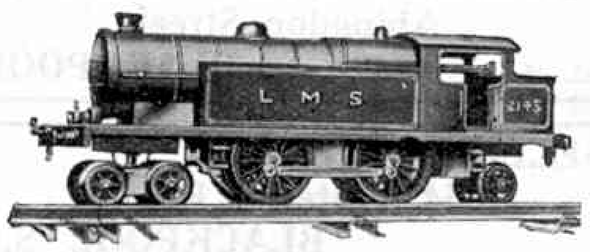

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STAMP ADVERTISEMENTS

(*Continued from page 74*)

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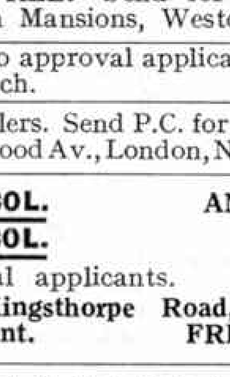

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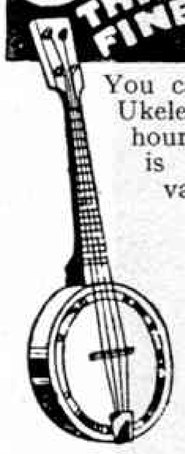

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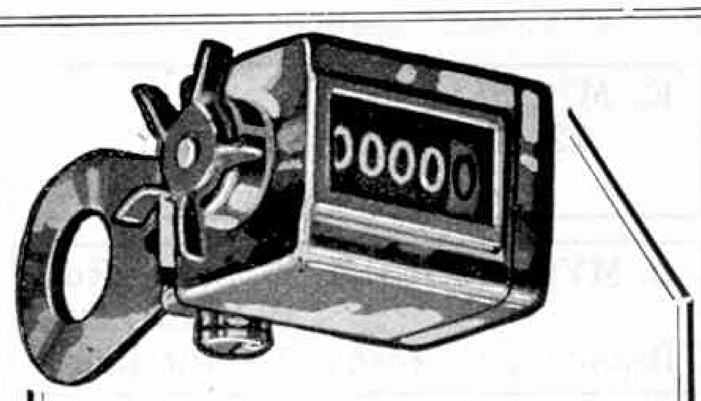

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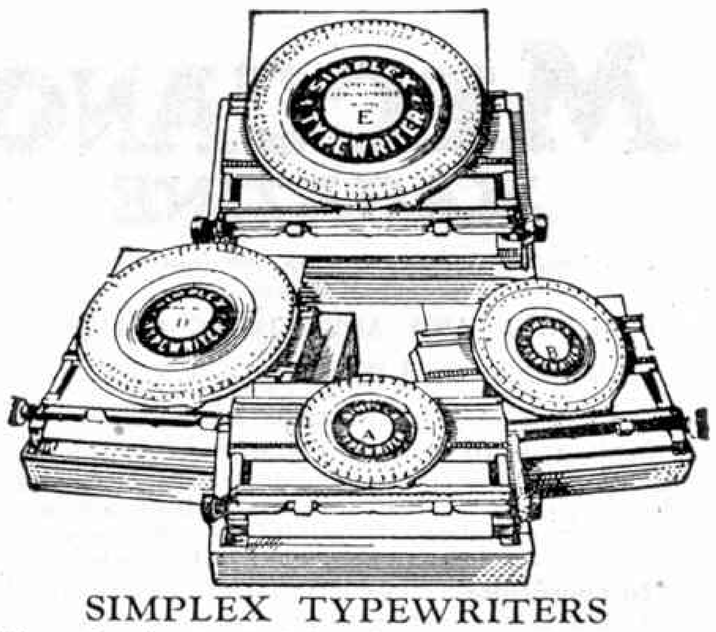

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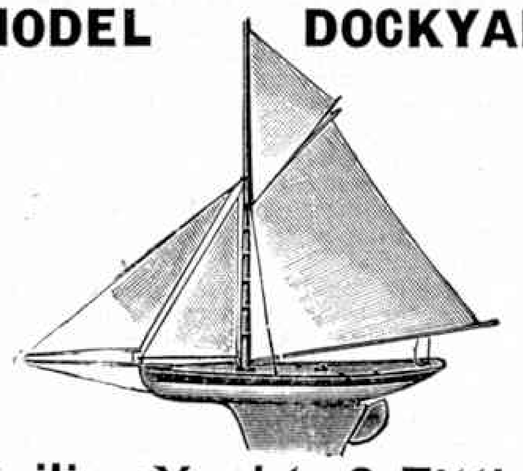

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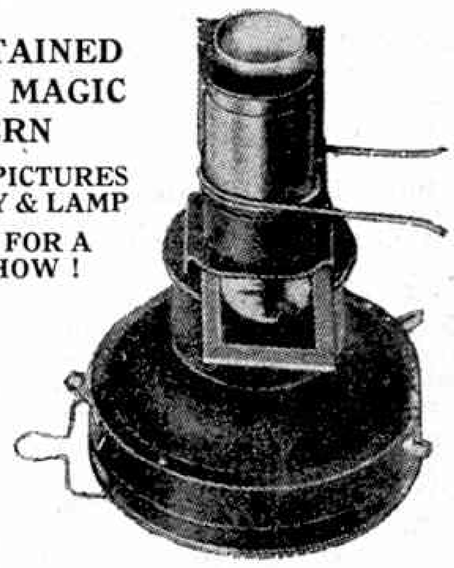

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Sale. Complete Miniature Train Set, cost over 30/–. For 16/–.—McKenzie, 103, Otago Street, Glasgow, W.2.

Magic Lantern for home use, electric, 70 Slides, also Vertical Steam Engine, 10 in. high. 25/–, or sell separately.—26, Montpelier Rise, Golders Green, N.W.11.

Sale. Adana Printing Machine. Complete. 25/– or best offer.—Thompson, 4, Montgomerie Gardens, Scotstoun, Glasgow.

For Sale. "Lucas" Dynamo Cycle Lighting Set, only used six months. Cost 25/–. Accept 12/6 or nearest.—A. Irish, Chapel Hill, North Petherton, Bridgwater.

Bowman 37/6 Loco and Tender, 21/– Loco, 8/– Bowman Rails, 7/– Tinplate. Perfect. Offers?—Williams, Union Terrace, Penzance.

Sale. The Faraday Box of Electrotechnics. With instructions. Only used twice. Cost 37/6. Offers? —R. Pritchard, Hollies, Carmarthen.

Sale. Baby Adana Press, as new, 5/6. "O" Brownie, unused, 3/–. Model Railway News, 1-40— Best offers.—T. Forrest, 19, Park Road, Timperley, Cheshire.

Sale. "Modern Boys," 1 to 150. "Holiday Annuals," 1926, 1928. Offers.—Adams, 28, Sudbury Heights Avenue, Greenford, Middlesex.

Sale. Sixty different Silver and Copper Coins of unknown worth. Offers to—Lupson, 17, Purley Park Road, Purley.

Must sell. 700 Foreign and Colonial Stamps, in an excellent Album for 25/–, catalogued £2/10/–. Reasonable offers accepted.—E. Knight, 3, High Beach, Felixstowe.

"Wide World" Magazines—True Travel and Adventure Stories (1927 to 1930 inclusive). Perfect condition. Send 1/– P.O. for sample copy, post free.—Bell, Bridge Street, Hawes, Yorks.

For Sale. Model Steam Engine, perfect, cost 25/–. First 12/6 secures.—Dobie, Crosby, Maryport.

Sale. One pair full-sized cricket pads, one pair batting gloves. Offers.—Levin, Box 1635, Johannesburg, S.A.

Sale. All good condition, "M.M.'s" September 1925 -December 1930; Lott's Tudor Bricks No. 7; Vertical Steam Engine; No. 2 Kodak Developing Tank complete. Cheap.—Gaukroger, 14, Lansdown Parade, Cheltenham.

Sale. Standard size Cinematograph, cost £3. 30/– or offers.—Lake, Crossways, Yelverton, Devon.

Wanted. Correspondents—Philatelists—South West Africa, Colonies. For Sale, ten volumes Boys' Own Paper, Strand Magazine, Stamp Collections.—P. Pritchard, 74, Stamfordham Drive, Allerton, Liverpool.

Cigarette Cards. Sets, Odds, Lots, Lists.—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Sale. "Meccano Magazines." 1925 (bound); 1926; 1927, except February, March, June, August; 1928, except December; 1929, except February; and 1930. Good condition. Best offer secures.—Quinton, The Knowle, Sewborne, Dorset.

"Meccano Magazines," 1927, 28 29. "Modern Boy," No. 1, down to date. All A.1. Offers.—J. Green, 10, Cemetery Road, Girlington, Bradford.

For Sale. A Miss America Boat, a good Air Rifle, a Brownie Crystal Set with two pairs of Earphones, and many other articles suitable for boys. All excellent condition, priced low. List on application. Apply—Dewar, 62, Queensborough Terrace, W.2.

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RAILWAY PHOTOGRAPHS.

We have just added a complete set (ten) of the "Schools" class to our list. Send 4d. for Specimen Photograph and list **M.10.** All Photographs postcard size, 3d. each, 2/6 doz.

Railway Photographs, 23, Hanover St., Liverpool.

CIGARETTE CARDS SPECIAL NEW YEAR OFFER

5 sets (200 cards) with Slip-in Album to hold 200 cards, **2/9** post free. New list of nearly 300 sets free.

THE BRITISH CIGARETTE CARD CO., 47, Lionel Road, Brentford, Middlesex.

Model Contests Results—(*Continued from page 48*)

by Dick Threlfall. The structure resembles a "sky-scraper" and on the roof carries windmill sails, the power from which is used to drive a dynamo and to work the mill machinery. Braced Girders and Strips are used extensively in building up the sides of the model. Special features include an endless bucket-elevator, and flap doors in the sides of the building, through which the sacks of milled produce are delivered to waiting lorries below.

A concrete mixer was submitted by Miss N. Bedlington. Her model is very neatly built and shows that she is quite familiar with the uses of the various Meccano parts.

Albert Pilgrim's model is a railway breakdown crane, in which the jib and superstructure swivel on a Meccano Ball Bearing. All the operations of which the model is capable, namely, slewing, travelling, and hoisting and lowering of the load and jib, are carried out by power supplied by a Meccano Steam Engine. The truck is fitted with four-wheeled bogies.

N. Phillips sent a well-built heavy-duty breakdown lorry, of the type used by motor garages for bringing in smashed up motor cars, or other road vehicles needing repairs.

I have been able to deal here only with a few of the most important models, and it is hoped that these short descriptions will give readers a general idea of the excellence of the majority of models entered in this Contest. I hope to be able to illustrate one or two more of the prize-winning entries in future issues of the "*M.M.*"

Answers to Christmas Puzzles—

(*Continued from page 77*)

No. 23. "K" is the missing letter and when this has been put in the correct places, the letters become :—"Kitty knitted khaki kilts."

No. 24. The measurement was "three inches over an ell." An ell, of course, measures 45 inches, and so the coded measurement was 48 inches or exactly 4 feet.

No. 25. The square should be divided as shown in Fig. 1.

No. 26. The six moves are :—12 to 3; 7 to 4; 10 to 6; 8 to 1; 9 to 5, and 11 to 2.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE :—

OLD SWAN, LIVERPOOL, ENGLAND.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/5 per copy (postage extra), and the subscription rates 9/6 for six months and 19/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 34, St. Patrick St., Toronto.
UNITED STATES: Meccano Co. of America Inc., New Haven, Conn. Meccano Co. of America Inc., 200, Fifth Av., New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

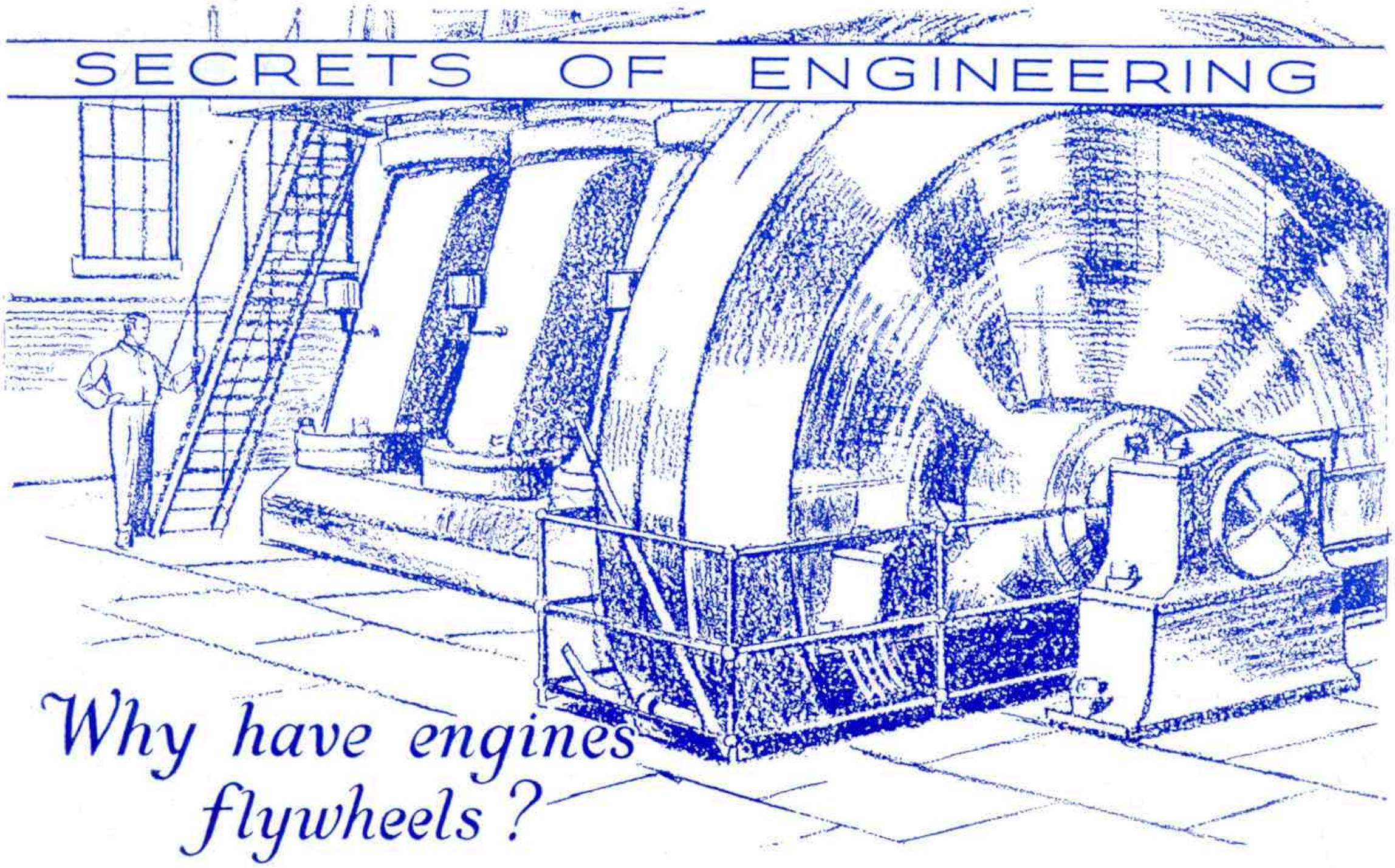
The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

December Mystery Photograph

It was not difficult to observe that our 24th Mystery Photograph represented a steel girder tower of some description. Actually it was a worm's eye view of one of the pylons used to support the overhead wires through which high voltage current is transmitted under the Scottish Central Electricity Scheme.

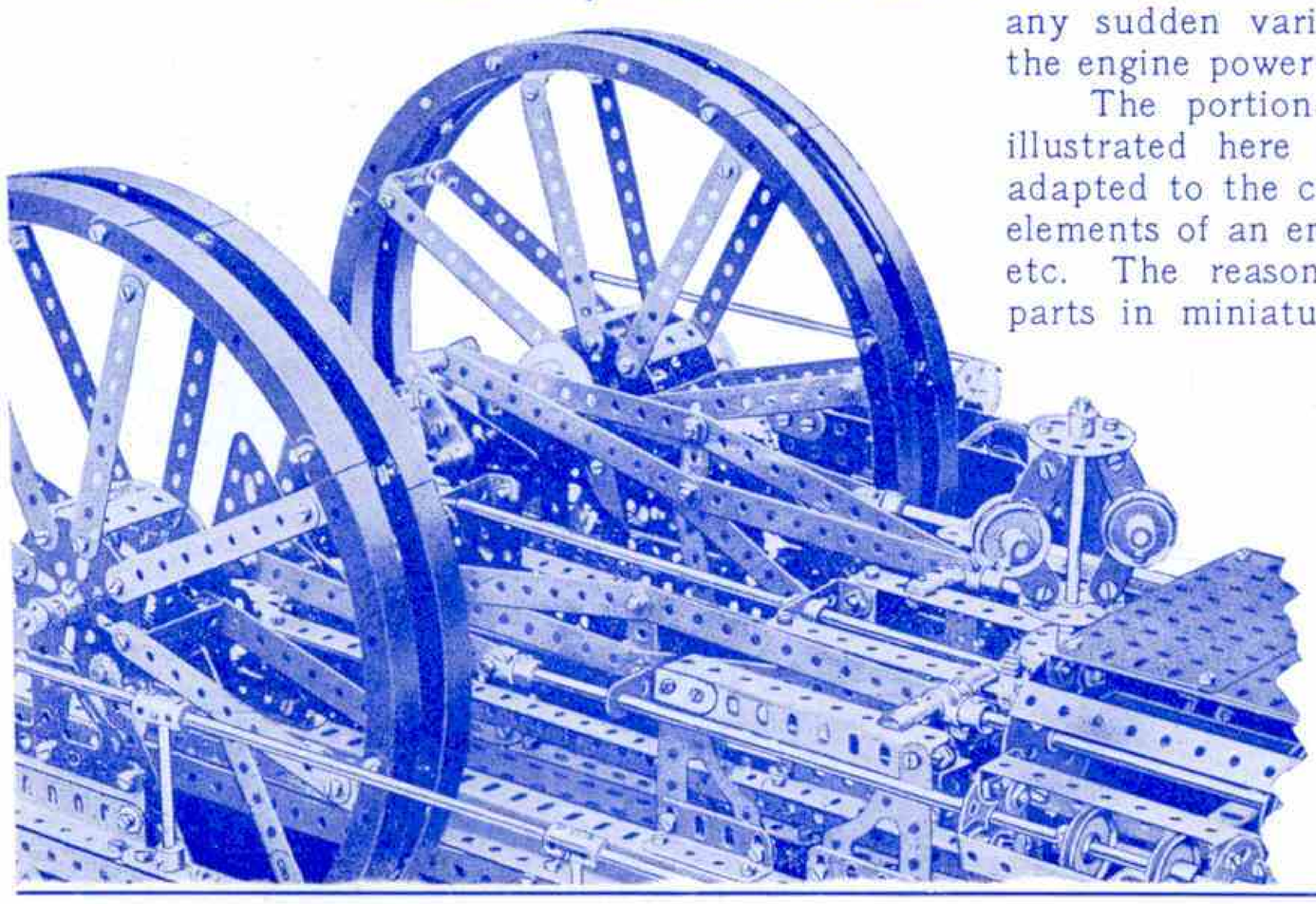
Many competitors guessed the identity of the object and very few were completely wide of the mark. The first correct solution received was from Wm. Stewart, Lenzie, to whom an autographed copy of the Editor's book "*Engineering for Boys*" has been sent.

SECRETS OF ENGINEERING



Why have engines flywheels?

Many types of engines are provided with flywheels in order to distribute their power evenly. A rapidly spinning wheel tries to maintain a uniform speed and resists any force that tends to make it spin faster or slower. In this manner the flywheel of an engine prevents to a large extent any sudden variations in speed resulting from fluctuations in the engine power or in the load.



The portion of a Meccano Twin Cylinder Steam Engine illustrated here shows how effectively Meccano parts can be adapted to the construction of flywheels and to other important elements of an engine, such as centrifugal governors, crankshafts, etc. The reason is that Meccano parts are real engineering parts in miniature—they can all be used in exactly the same manner as the corresponding parts in real engineering practice. More important still, they are all standardised and interchangeable, and thus can be used to make hundreds of different engineering models.

Ask your dealer to show you the 1930 Meccano Outfits.

There are Meccano Outfits at all prices from 2/- to 450/-

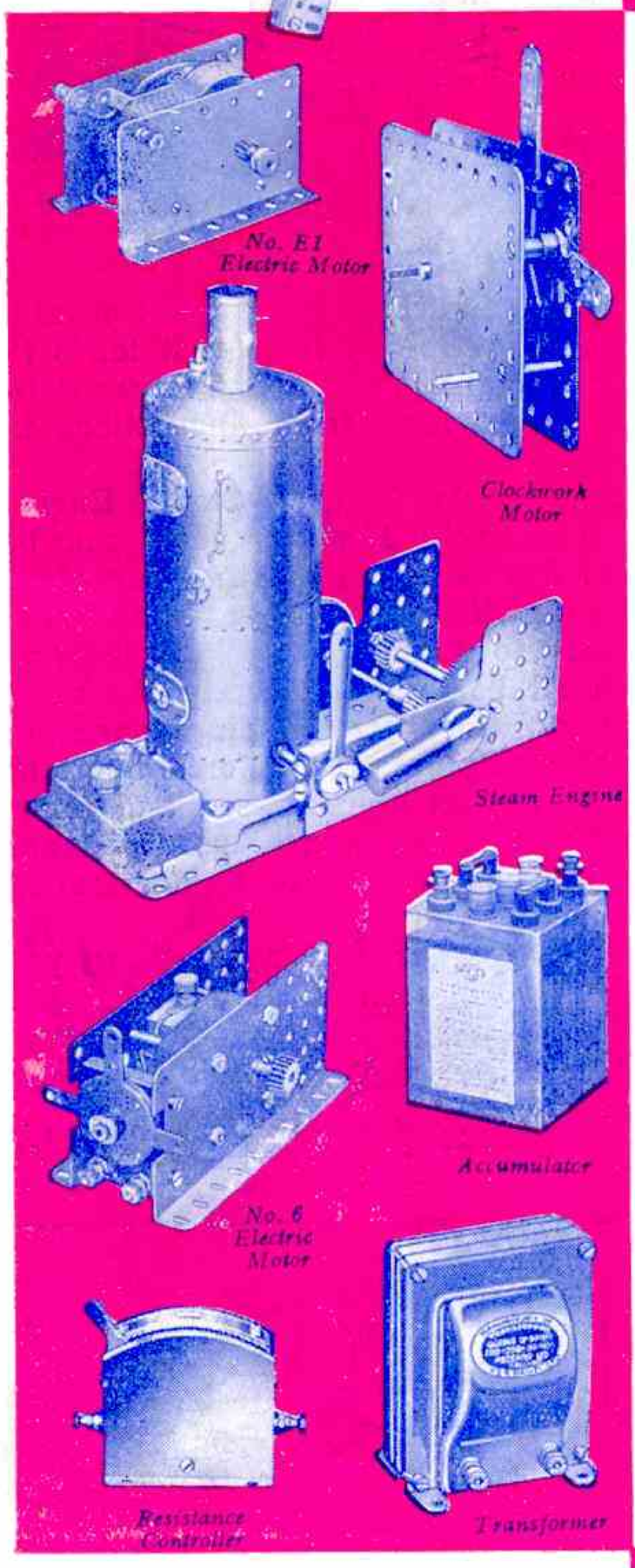
MECCANO

The Toy that made Engineering Famous

MECCANO LIMITED — OLD SWAN — LIVERPOOL

Run your Model with a Meccano Power Unit

This is a splendid Meccano model of the Bennie "Railplane," the invention of Mr. George Bennie of Glasgow. The Railplane system of transport makes use of cars suspended from an overhead structure and propelled at high speed by means of airscrews.



If you want to obtain the fullest possible enjoyment from the Meccano hobby you should operate your models with a Meccano Motor or Steam Engine. You push over the control lever of the motor or engine and immediately your Crane, Motor Car, Ship Coaler or Windmill commences to work in exactly the same manner as its "big brother" in real life. Could anything be more exciting?

The Meccano Motors and Steam Engine are strongly made and the utmost care is taken in their manufacture to ensure that they will give satisfaction. The side plates and bases are pierced with the standard Meccano equidistant holes, which enables a motor or engine to be built into any Meccano model in the exact position required.

Particulars and prices of the Steam Engine, Motors and various Accessories are given below.

MECCANO ELECTRIC MOTOR E1 (6-volt)

This is a highly efficient electric motor (non-reversing) that will give excellent service. A 6-volt Accumulator will operate it, but it may also be driven from the main (alternating current only) through the Transformer described below. Price **7/6**

MECCANO ELECTRIC MOTOR No. 6 (6-volt)

This powerful and reliable 6-volt Motor may be run from a 6-volt accumulator or, by employing the Transformer described below, from the main. It is fitted with a control mechanism that enables the motor to be started, stopped or reversed as desired. Price **15/6**

NOTE.—The above Electric Motors will not run satisfactorily from dry cells.

MECCANO ACCUMULATOR (6-volt, 20 Amps.)

The Meccano Accumulator is of substantial construction and is specially recommended for running the Meccano 6-volt Electric Motors. Price **28/6**

TRANSFORMER

By means of this transformer the Meccano 6-volt Electric Motors may be driven from the main supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Price **30/-**

MECCANO RESISTANCE CONTROLLER

By employing this variable resistance the speed of the Meccano 6-volt Electric Motors may be regulated as desired. The controller is connected in series with the motor and accumulator, or with the motor and transformer if a transformer is used as the source of power. It will not regulate the speed of a high-voltage motor connected to the main. Price **4/6**

MECCANO CLOCKWORK MOTOR

This splendid Motor is a compact self-contained power unit. An efficient governor controls the powerful spring that is fitted on the motor and ensures a long steady run at each winding. Brake and reverse levers enable the motor to be stopped, started and reversed as required. Supplied complete with winding key and full instructions. Price **7/6**

MECCANO STEAM ENGINE

On actual test this powerful steam unit has lifted over 56 lbs. A single cylinder of the oscillating type is employed, steam being admitted to it through a special reversing block. Operation of the reversing lever enables the crankshaft to run in either direction. The spirit container for the lamp is placed well outside the boiler-casing, eliminating all risk of the spirit becoming heated. There is no danger whatever of the boiler exploding. Price **25/-**

MECCANO LIMITED : OLD SWAN : LIVERPOOL

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